NAVAL POSTGRADUATE SCHOOL
Monterey, California

19980807 038

THESIS

SUITABILITY OF MRP II TO MATERIAL PLANNING FOR COMPONENT REPAIR AT NAVAL AVIATION DEPOT, NORTH ISLAND

by

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June, 1998

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DTIC QUALITY INSPECTED 1

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.

1. AGENCY USE ONLY *(Leave blank*	2. REPORT DATE June, 1998	3. REPORT TYPE AND DATES COVERED Master's Thesis

4. TITLE AND SUBTITLE : SUITABILITY OF MRP II TO MATERIAL PLANNING FOR COMPONENT REPAIR AT NAVAL AVIATION DEPOT, NORTH ISLAND

5. FUNDING NUMBERS

6. AUTHOR(S)
O'Brien, Timothy J.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Postgraduate School
Monterey, CA 93943-5000

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
N/A

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT ***(maximum 200 words)*** Manufacturing Resource Planning (MRP II) is being implemented at Naval Aviation Depot, North Island (NADEP NI) to combat chronic material deficiencies. MRP II is a planning tool designed for scheduling manufacturing activities with known demand. NADEP NI is a job shop component repair facility with component forecast error ranging up to 800 percent, making the suitability of MRP II questionable. This research studies material planning at NADEP NI to identify forecast error, probability of part replacement error, and material lead-time variability in order to make recommendations for success in implementing MRP II. Fifteen percent of requisitions for work-in-process components are between one and two years old. If lead-times are reduced to a maximum of one year, the planning horizon can be reduced. Work-in-process inventories can also be reduced by 2.3 million dollars based on 26 components sampled from the top revenue generators. Currently material is ordered five weeks prior to the repair quarter. Ordering material when the forecast is generated can reduce work-in-process inventories by 6.2 million dollars for the sample components.

14. SUBJECT TERMS
MRP II, Component Repair, Forecasting

15. NUMBER OF PAGES 126

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

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SUITABILITY OF MRP II TO MATERIAL PLANNING FOR COMPONENT REPAIR AT NAVAL AVIATION DEPOT, NORTH ISLAND

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

Manufacturing Resource Planning (MRP II) is being implemented at Naval Aviation Depot, North Island (NADEP NI) to combat chronic material deficiencies. MRP II is a planning tool designed for scheduling manufacturing activities with known demand. NADEP NI is a job shop component repair facility with component forecast error ranging up to 800 percent, making the suitability of MRP II questionable. This research studies material planning at NADEP NI to identify forecast error, probability of part replacement error, and material lead-time variability in order to make recommendations for success in implementing MRP II. Fifteen percent of requisitions for work-in-process components are between one and two years old. If lead-times are reduced to a maximum of one year, the planning horizon can be reduced. Work-in-process inventories can also be reduced by 2.3 million dollars based on 26 components sampled from the top revenue generators. Currently material is ordered five weeks prior to the repair quarter. Ordering material when the forecast is generated can reduce work-in-process inventories by 6.2 million dollars for the sample components.

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LIST OF ACRONYMS

AIMD	Aviation Intermediate Maintenance Depot
AWI	Awaiting Induction
AWP	Awaiting Parts
BOM	Bill of Material
BRAC	Base Realignment and Closure
CRC	Component Repair Conference
DDDC	Defense Distribution Depot, California
DLA	Defense Logistics Agency
DLR	Depot Level Repairable
DoD	Department of Defense
DOP	Designated Overhaul Point
DSP	Designated Support Point
FIC	Family Identification Code
FISC SD	Fleet and Industrial Supply Center, San Diego
IIC	Item Identification Code
MRP II	Manufacturing Resource Planning
MRP	Material Requirements Planning
NADEP NI	Naval Aviation Depot, North Island
NADEP	Naval Aviation Depot
NAVAIR	Naval Air Systems Command
NAVICP-Phil	Navy Inventory Control Point - Philadelphia

NAVSUP	Naval Supply Systems Command
NIIN	Navy Item Identification Number
NIMMS	NAVAIR Industrial Material Management System
NRFI	Not Ready For Issue
OST	Order and Shipping Time
RF	Replacement Factor
RFI	Ready For Issue
RTAT	Repair Turnaround Time
TAT	Turnaround Time
UA	United Airlines
UAMOC	United Airlines Maintenance Operations Center

I. INTRODUCTION

A. PURPOSE

Current naval doctrine is focused on littoral warfare and power projection over the horizon ashore. Air power through the deployment of carrier battle groups and amphibious ready groups is critical to the Navy's ability to meet that vision. Aviation readiness is directly linked to the ability of Naval Aviation Depots (NADEPs) to meet component repair requirements and to keep the fleet supplied with high quality repair parts. NADEP's ability to manage the Not Ready for Issue (NRFI) repair process has a tremendous impact on turnaround time (TAT), component pipeline inventory, repair costs, and fleet readiness.

NADEPs have been under increasing pressure to improve the efficiency and effectiveness of their processes. Through Base Realignment and Closure (BRAC), the Navy has reduced the number of active NADEP's to three. Popular emphasis on privatizing and outsourcing non-core functions and the expectation of another round of BRAC has put added pressure on NADEPs to improve their efficiency in order to ensure their long-term viability. In addition, shrinking defense budgets limit large scale acquisition programs and have caused defense contractors to expand their focus to the

maintenance arena as a means of securing defense contracts. This added competition increases the pressure on the NADEP'S to improve their efficiency.

As a means of improving efficiency and the ability to meet customer requirements, Naval Aviation Depot, North Island, California (NADEP NI) is committed to improving the component repair process. As a result, NADEP NI is implementing a resource planning system. The goal is to improve the overall ability to schedule and manage all resources and to maximize efficiency and productivity.

Material Requirements Planning (MRP) is a management philosophy that focuses the planning of material requirements to an identified production objective. The goal is to ensure materials are in place in time to meet production requirements without interruption to the schedule. Failure to provide the right materials to the production line when needed slows the production process, increases TAT, increases costs, and degrades the quality of the product and/or service provided to the customer.

Advancements in computer and information technology enabled MRP to be expanded to cover planning of other resources, not just material requirements. These resources include labor requirements, equipment capacity, plant facilities, transportation, warehousing, information

management, etc. The underlying tenet of resource planning is establishing a master schedule and having a robust information management system capable of adjusting resource planning requirements in concert with adjustments to the master schedule. This refinement of MRP is referred to as Manufacturing Resource Planning and is commonly called MRP II.

Traditional defense supply support is predicated on establishing inventory profiles that are demand based. Such systems are focused on historical demand and are not responsive to forecasted changes in demand. Because these systems focus on the past, they generally lag actual demand. This partially explains the accumulation of obsolete material and the lack of consistency of getting the right material to the customer in time to meet their requirements. If inventory levels are determined by looking to production history, is it possible to quickly adjust inventory profiles in response to changes in forecasted production? This research will examine this question and it's impact on MRP II in the component repair environment.

MRP II requires an accurate forecast of requirements in order to be effective. The forecast horizon must exceed the longest material lead-time in order to achieve accurate resource planning. A master production schedule can then be

established based on this forecast. Once a master production schedule is established, resource planning is focused on meeting the master schedule. In order for MRP II to work effectively, functions and processes that impact the production schedule must occur on time with a high degree of confidence. Variability in any phase of planning reduces the chances of meeting the master production schedule. This same principle applies to the schedule itself. If the forecast is not accurate, then the master schedule can not be expected to be accurate. Any variability in the forecast, production schedule, or in any aspect of resource planning diminishes the probability that the goals of the master schedule will be met. Variability in the forecast causes a domino effect in the resource planning. Supporting activities go into crisis mode in order to support changes to the production schedule making it more difficult to meet the due date. These attempts to play catch-up in the planning cycle result in cost overruns and schedule delays.

B. OBJECTIVE

The purpose of this research is to analyze the component repair process at NADEP NI and to determine if the implementation of MRP II can enhance that process with respect to material requirements planning. Currently, when

NADEP NI cannot complete repair on a not-ready-for-issue (NRFI) component (categorized as F condition) due to unreceived parts, the component goes into an awaiting parts status known as G condition. The average time that components are in G condition at NADEP NI is an average of 192 days. NADEP NI currently has more than 163 million dollars worth of components in G condition waiting on more than 17 million dollars worth of parts. In addition, the G condition inventory adds significantly to the pipeline inventory investment that the Navy must fund. This condition also degrades aircraft overhaul processes and hurts fleet readiness.

The current method of parts procurement does not adequately support the repair process. In this light, NADEP NI is in the process of implementing MRP II as a means of improving the repair process and also to improve material availability to support this process. The question is raised whether current Department of Defense (DoD) processes are suitable to support that effort and whether any modification in the system or in the MRP II implementation is warranted. This research examines the requirements of an effective MRP II process relative to current DoD practices, including forecasting component repair inductions, identifying material requirements, and in the ability of the

supply system to deliver material in time to meet production schedules. This research also makes recommendations for improving the process in order to reduce component repair turnaround time, to reduce pipeline inventory, and to reduce production costs. The goal of this analysis is to improve the repair process at NADEP NI. It also has applications to the Fleet and Industrial Supply Center, San Diego, California (FISC SD), as the primary supplier for parts in the repair process at NADEP NI and to the Navy Inventory Control Point, Philadelphia, Pennsylvania (NAVICP-Phil), as the owner of the components being repaired.

C. RESEARCH QUESTIONS

This research addresses the following research questions:

- What are the current forecasting criteria for component induction?
- How much variation is there between forecasted and actual component induction?
- How are material requirements for a specific component determined and what is the variability in material requirements for component repair?
- What is the order and shipping time (OST) for parts needed for a specific component repair when requisitioned through the Navy supply system?
- What is the variability in order and shipping time (OST) and how does that impact the component repair process?

- How can current material planning processes be improved in order to facilitate the component repair processes, reduce turnaround time, and to better utilize MRP II?

D. SCOPE, LIMITATIONS, AND ASSUMPTIONS

This thesis is an analysis of whether the current supply system has the capabilities to effectively support the implementation of MRP II at NADEP NI. There are approximately 30,000 components in NADEP NI's database for which there is historical data. Of these, approximately 3,500 make up NADEP NI's active component workload. Of these active components, approximately eighty percent of NADEP NI's revenue generation is attributed to 260 families of components. The focus of this research is on these 260 component families. Ten percent of the revenue generators or 26 components are randomly selected for analysis.

An analysis of the repair process is conducted to determine variability in the overall process. The analysis looks at forecasted inductions, parts requirement identification, and total logistics delay time for the component repair process. The intent is to identify variability in each individual facet and then in the total process and to determine the impact of such variability on the ability to successfully implement MRP II. Potential process enhancements and improvements are also examined to

determine possible quality improvements in implementing MRP II.

Processes at United Airlines (UA) are used for comparison purposes with NADEP NI and to determine possible enhancements that may be applicable to NADEP NI and also to identify cultural barriers in the Navy that might impede MRP II implementation.

The research focuses on 26 randomly selected components from the population of components, which are the top revenue generators for NADEP NI. The results of the research are assumed to be applicable to the general population of components. The findings of the specified components are considered to be indicative of the processes that control all component repair and, therefore, conclusions can be applied to these processes overall.

The findings of this research document the ability of the existing supply system to support the implementation of MRP II. Therefore, the conclusions have applicability to NADEP NI's implementation planning so that processes can be modified to improve efficiency. In addition, the research provides answers to the fundamental question of whether the existing supply system is sufficiently flexible to support initiatives that are deemed necessary to improve efficiency and cost effectiveness of depot repair processes, i.e. MRP

II. This has implications regarding policy decisions by Naval Air Systems Command (NAVAIR), NAVICP-Phil, and Naval Supply Systems Command (NAVSUP) regarding the future of the Navy's supply system and support provided to all NADEPs.

E. ORGANIZATION OF RESEARCH

The methodology used in this thesis research consists of the following steps:

- Conduct a literature search of books, periodical articles, CD-ROM systems, and other library information resources for background information.
- Visit NADEP NI to observe operations, examine current practices, and collect data on current component repair planning and production.
- Visit United Airline's maintenance hub at San Francisco airport focusing efforts on examining the component repair facility to observe operations, examine industry practices, and discuss process issues.
- Prepare a baseline assessment to document current repair processes at NADEP NI and make comparisons to those practices employed at United Airline's maintenance hub.
- Determine the minimum supply system performance parameters required to meet the production goals of MRP II at NADEP NI.
- Determine the current levels of performance regarding logistics support at NADEP's component repair process.
- Identify bottlenecks to desired MRP II goals within the current supply system.
- Determine the likelihood of meeting desired MRP II goals using the current supply system.

- Make recommendations to decrease or eliminate the bottlenecks and identify expected benefits to turnaround time and pipeline inventory.
- Make recommendations on findings.

F. ORGANIZATION OF THESIS

The approach to conducting the research begins with an overview of MRP II and how it will be implemented at NADEP NI. This will include a review of the expected benefits to NADEP NI and the critical paths to successful implementation, including barriers and bottlenecks. A comparison is conducted between United Airlines' maintenance facility at San Francisco airport and NADEP NI to highlight differences in organizational structure and processes. Once the basic organizational processes are identified, 26 components are identified that typify NADEP NI's component repair process. The maintenance and material requirement histories for those components are studied to identify variability in the process and to focus on areas that can be improved to better support MRP II. Finally, conclusions and recommendations are provided for improving supply support for improving the implementation of MRP II at NADEP NI, reducing repair costs, reducing repair turn around time, and reducing component pipeline inventory. The research

concludes with recommendations for further research on this issue.

II. MANUFACTURING RESOURCE PLANNING (MRP II)

A. EVOLUTION OF MRP II

MRP was first introduced to manufacturing as a means of managing material procurement and delivery to ensure that material was received in time to meet identified production schedules. However, the ability to deliver the goods on time was only as good as the initial schedule and the likelihood that the schedule would not vary, or if it did, that the changes were provided to the material managers in time to adjust material due dates.

Unfortunately, schedule variation leads managers and supervisors at various levels of an organization to develop their own work-arounds in order to offset the shortcomings of an invalid or rapidly changing schedule. Expedite lists, shortage lists, excessive material handling, double ordering, and the use of exaggerated ordering priorities as insurance against schedule variation are all means of dealing with an unreliable production schedule. In short, ineffective systems breed more systems.

With rapidly improving information technology, the scheduling problem becomes much more manageable. If a computer-based master schedule is developed and tied to resource planning, including labor, material management,

procurement, transportation, facilities requirements, etc., adjusting resource requirements becomes much easier to manage. One adjustment in the master schedule can trigger appropriate adjustments in the resource planning of any and all resources. Schedule changes must be distributed to all the players and computer technology provides the means to do that. However, unless the schedule is valid, the customer's requirements will not be met.

Expanding the management processes to include all production resources changed Material Requirements Planning (MRP) into Manufacturing Resource Planning (MRP II). This expansion is possible through the development of advanced information technology.

MRP II allows all facets of an organization to plan based on the same schedule and the same information. It allows production, inventory managers, purchasing, schedulers, and customers to plan their activities based on the same master schedule. The operating and financial systems are, in effect, one and the same. MRP II also allows "what if" scenarios to be examined to determine the impact of hypothetical policy changes or schedule adjustments. Figure 2-1 diagrams an effective MRP II system.

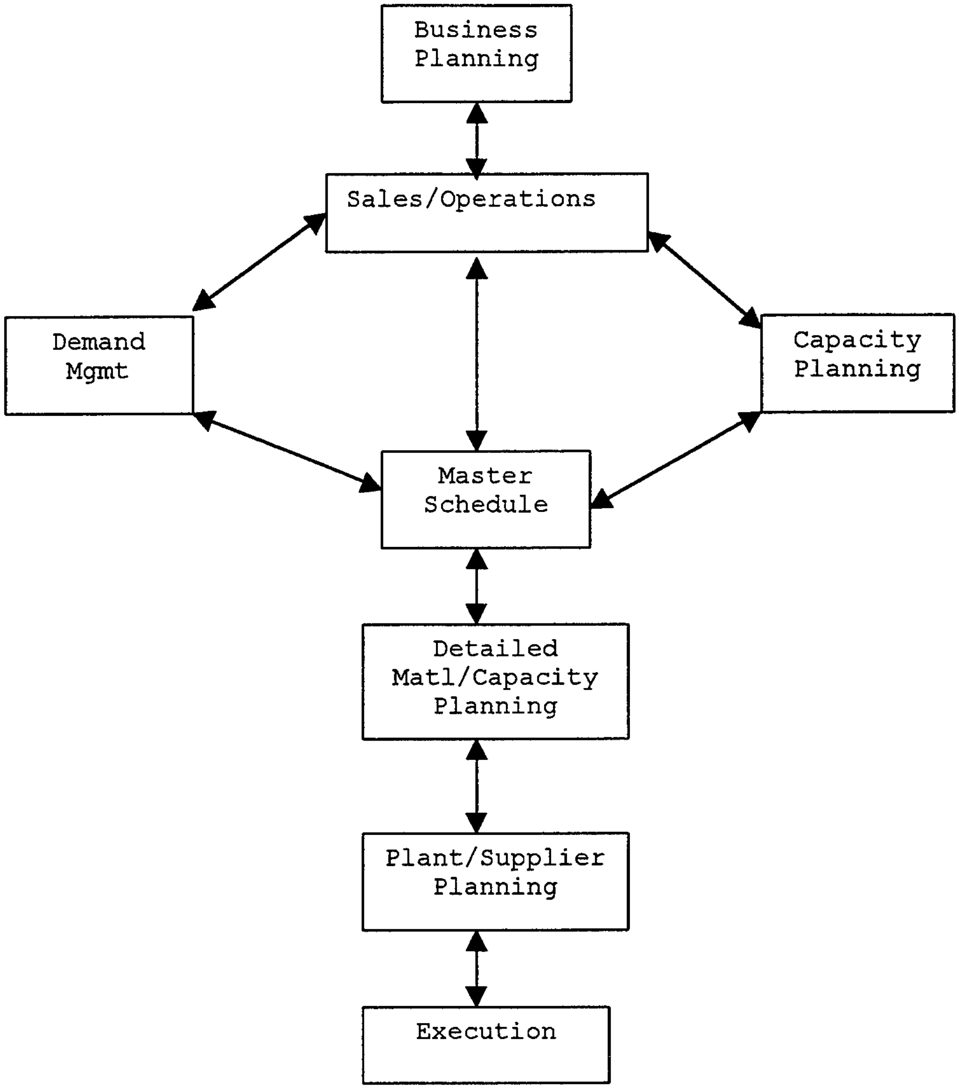

Figure 2-1. Manufacturing Resource Planning (MRP II)

B. APPLICATIONS AND BENEFITS OF MRP II

1. Applications of MRP II

As indicated in Figure 2-1, the driver in MRP II is business planning. Knowing the customer and the customer's needs is paramount to effective business planning. This is

the basis for developing an effective marketing strategy, and, in turn, for identifying the products that need to be produced and the date required. MRP II has applications to the following types of organizations:

1. An organization that manufactures a make-to-stock product,

2. An organization that manufactures a short delivery lead time make-to-order product, and

3. An organization that manufactures a long delivery lead time make-to-order product.

These categories mark a significant deviation from NADEP NI's production environment. NADEP NI's component repair process is not the same as a manufacturing process and therefore cannot easily be placed in any of these three categories. In a manufacturing process, a unit is produced from scratch. All units of the same product require the same combination of parts in the manufacturing process. In the component repair process, ten repair jobs for the same component can require ten different combinations of replacement parts to return those components to A condition status. Figures 2-2 and 2-3 highlight the differences between a traditional MRP II environment and the environment at NADEP NI.

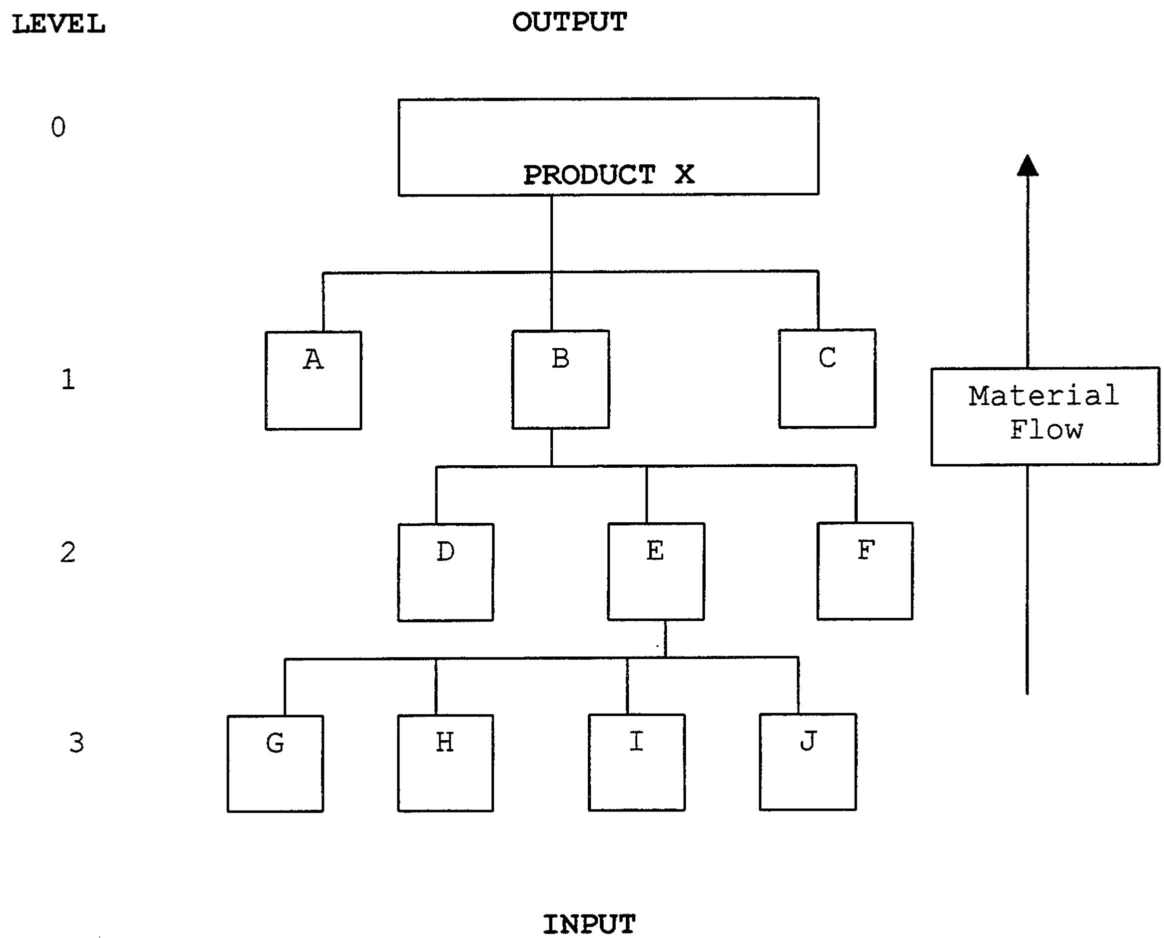

Figure 2-2. Traditional MRP II Product Structure

Figure 2-2 shows the traditional product structure under MRP II. The product does not vary and the same parts are utilized in the same combination every time the product is manufactured. This is in stark contrast to Figure 2-3, which shows the repair process structure for a component at NADEP NI. Material requirements vary for the same component depending on the degree of repair required for that

particular unit. Any combination of individual parts or subassemblies might require replacement during the process. Hence, there is much more variability in material requirements for a repair process versus a manufacturing process.

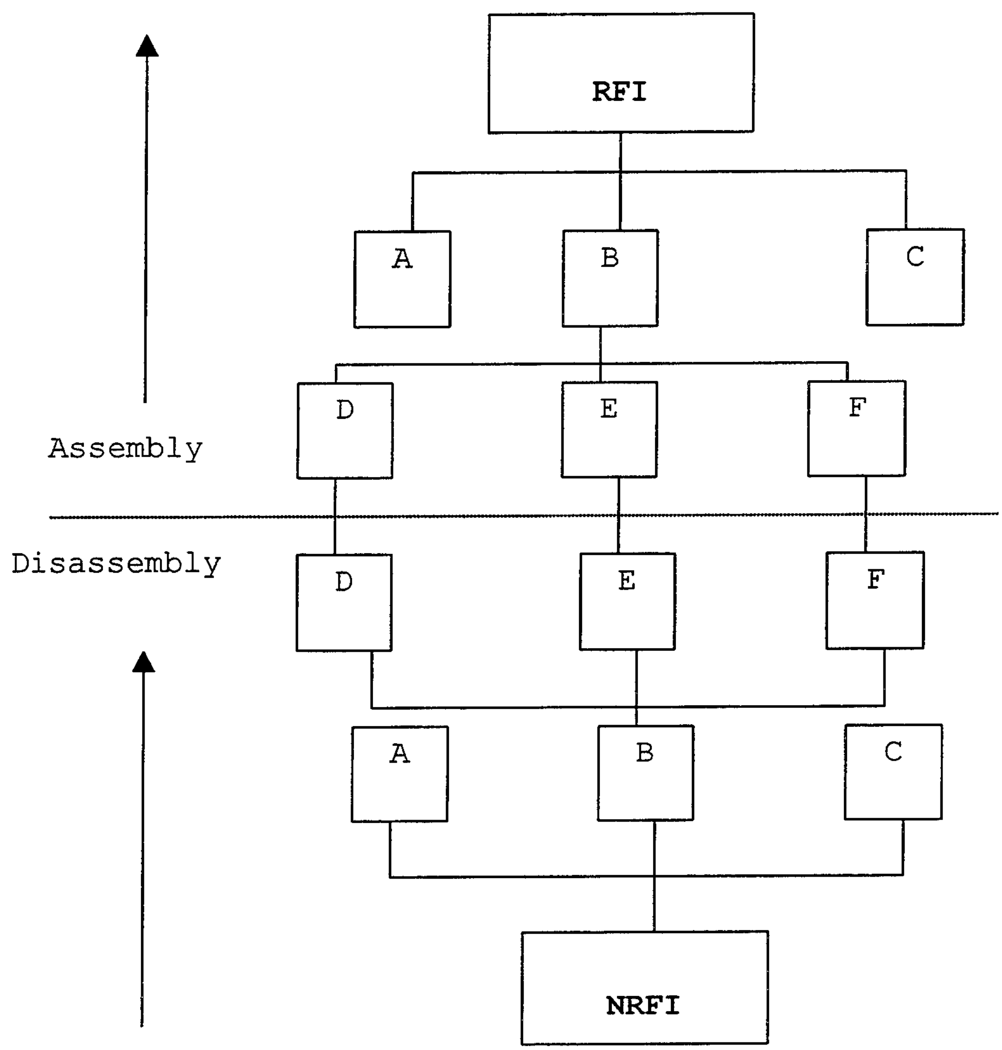

Figure 2-3. NADEP NI Component Repair Structure

NADEP NI's finished products can either be put back in inventory, sent to the fleet to fill an immediate requirement, or utilized in aircraft overhaul processes at NADEP NI.

2. Benefits of MRP II

The degree of MRP II implementation can vary widely from one organization to another. The degree to which an organization has achieved implementation is categorized into four classes:

1. Class A - MRP II is used so effectively there is no shortage list.

2. Class B - MRP II has a very good production and inventory control system, but has not extended it to the entire organization.

3. Class C - MRP II is used as a better inventory control system and is used for order launching.

4. Class D - MRP II is primarily used as a data processing system with little impact on operations.

As an organization reaches higher levels of MRP II implementation, productivity gains are more prevalent. The overall effect is to smooth production rates. When production rates become more stabilized, the result is reduced waste and an organization with far more flexibility, allowing rapid response to changes in demand.

Since inventories are maintained as insurance against unforeseen production requirements, inventory reduction is a

by-product of stabilized production. Again, this can be attributed in part to maintaining a viable, up-to-date schedule. Additional productivity improvements are possible in budgeting, purchasing, inventory management, labor management, overtime reduction, improved quality control, and better customer service.

For the purpose of this research, only forecasting, material planning, and OST aspects of resource planning are studied. Improving these areas of production support has tremendous potential to improve NADEP NI's overall performance since NADEP NI has over 163 million dollars worth of components in G condition waiting on over 17 million dollars worth of parts.

C. MRP II IMPLEMENTATION AT NADEP NI

NAVAIR is aggressively pursuing the implementation of MRP II at all NADEPs in an effort to improve cost and schedule performance. This dictates that the NADEPs must switch from a historical-based resource management method to a forecast-based management philosophy. The planning horizon must exceed that of the longest material lead-time and the mechanisms that ensure material availability must be put in place.

The process value chain requires contributions from several activities, including NAVAIR, NAVICP-Phil, FISC SD,

Defense Logistics Agency (DLA), and NADEP NI. All must be committed to making changes in their current processes and operations in order to ensure the success of MRP II.

NADEP NI is in the process of preparing for MRP II implementation and is scheduled to go live with this system by 1 October 1998. The instrument shop (shop 3606) will be the first shop to go live on 1 October. Implementation in the six remaining shops is time phased from January 1999 through April 2000. This phased approach is intended to allow required processes, information management systems and interfaces, training, material requirements, and organizational interfaces to be put in place prior to bringing each shop on line. A phased approach eases the management of the implementation process and reduces learning time in later shops.

MRP II implementation is part of a broader initiative that is designed to incorporate financial management, tool inventory management, data management, facilities and equipment management, inter-service material accounting, and other management systems in order to allow total resource management.

The expected benefits to NADEP NI as taken from NADEP NI's Depot Maintenance System Concept of Operations include accurate forecasts of depot workload and effective

management of internal resources. However, MRP II stresses that accurate forecasts of depot workload should not be considered a benefit to be derived, but rather a specific prerequisite for the successful implementation of MRP II. A stable forecast will certainly allow more effective workload and resource scheduling, but it cannot be considered a metric with which to evaluate the success of the implementation process. Specific benefits expected include the ability to:

- Forecast total depot workload and manage availability of material, skills, facility equipment, and tool inventories;
- Plan, design, develop work packages and schedule all production efforts;
- Collect data against the plan in terms of both labor hours and material usage by operation or activity as defined by production management;
- Review and negotiate workloads and establish budgets for forecasted workloads; and
- Account for costs and financially track the status of all funded workload against a budget.

The incremental deployment strategy is critical to the success of the system implementation. From the depot management perspective, expected benefits include improved ability to:

- Make long term projections allowing higher quality strategic decisions regarding resource investments;

- Support the Navy/DoD budget process;

- Identify performance problems early;

- Capture and store data directly related to a component for maintenance program analysis;

- Reduce depot operating costs by improving practices; and

- Reduce component turnaround time through improved scheduling and resource management.

As indicated earlier, several organizations play a critical role in the success of MRP II implementation at NADEP NI. NAVICP-Phil, as the owner of the components to be repaired, must provide NADEP NI with an accurate forecast of components to be inducted into the repair process. NAVICP-Phil is a stakeholder in making the process more efficient since reducing repair turnaround time (RTAT) can help reduce component pipeline inventory investment funded by NAVICP-Phil. Since a reliable induction forecast is a prerequisite to achieving accurate resource planning, NAVICP-Phil's role is critical to successful implementation.

NAVAIR is responsible for maintaining the Navy's aviation industrial capability. NAVAIR is the source of funding for the NADEPs and is highly concerned with

preserving the Navy's depot system. Threats to the long-term viability of the NADEPs include the expectation of a third round of BRAC and pressure to outsource and privatize depot functions. In addition, the decreasing defense budget pressures major claimants to reduce Operations and Maintenance, Navy (O&MN) funding requirements in order to fund weapon system development and procurement for capital investment. For these reasons, NAVAIR is a major stakeholder in NADEP NI's ability to improve efficiency and productivity. NAVAIR influences the NADEPs by instituting policy and thus has an impact on the implementation of MRP II and its outcome.

FISC SD and DLA are also stakeholders. FISC SD is NADEP NI's liaison for supply matters with responsibilities that include inventory management of end-use material, material procurement, and management of G condition components. DLA owns the majority of the parts that are required for component repairs. Acceptable OST for these items is a critical requirement for successful MRP II implementation.

These organizations have competing interests and are rewarded and incentivized differently. These competing interests could provide barriers and hurdles to the successful implementation of MRP II.

III. BUSINESS PRACTICES AT NADEP NI AND UNITED AIRLINES MAINTENANCE OPERATIONS CENTER

A. INTRODUCTION

This chapter examines the repair processes at both NADEP NI and United Airlines Maintenance Operations Center (UAMOC) to identify current practices at both facilities and to compare and contrast those practices. The author acknowledges that there are significant differences in performance motivation between these two organizations. As a Navy Working Capital Fund (WCF) activity, NADEP NI must complete its mission in a manner that produces a Net Operating Result (NOR) of zero by the end of the fiscal year. NADEP NI must recover all costs without producing a profit. UAMOC, on the other hand, must complete the same basic function as NADEP NI in a manner that maximizes profit for United Airlines. However, both organizations operate in job shop environments with the purpose of returning NRFI aviation components to RFI condition.

With this in mind, it is useful to examine the practices of the two in order to identify areas within NADEP NI for possible improvement. To identify differences in OST between the two organizations, the examination of business

practices focuses on forecasting component induction demand, estimating parts requirements and requisitioning parts.

B. NADEP NI BUSINESS PRACTICES

This section examines practices utilized by NADEP NI and other DoD agencies in the component repair processes.

1. Responsibilities of Other Agencies

While NADEP NI is a Designated Overhaul Point (DOP) for identified components, there are three other organizations that play a critical role in the process. FISC SD is considered the Designated Support Point (DSP) to NADEP NI. The DSP's responsibilities include monitoring and expediting requisitions, transferring custody and updating the condition code of components, and maintaining custody of G condition components while awaiting parts or induction into the repair process.

As indicated in Chapter I, NAVICP-Phil owns the aviation components that NADEP NI repairs. As the owner of the material, NAVICP-Phil is responsible for forecasting induction requirements and providing that information to NADEP NI for scheduling and resource planning. NAVICP-Phil is the inventory manager for all Navy aviation components.

DLA owns and manages the wholesale stock that NADEP NI uses to repair components. DLA maintains warehousing and

distribution centers throughout the continental United States. Material that is required to complete the repair of a component is requisitioned from DLA who is responsible for managing those items and filling customer orders.

2. Levels of Maintenance

The Navy utilizes three levels of maintenance for aviation component management: Organizational (O-level), Intermediate (I-level), and Depot (D-level).

Squadron maintenance personnel perform O-level maintenance at the squadron level. These actions generally include preventive maintenance, minor repairs, and removing and replacing components that are degraded or inoperational. The primary focus of O-level maintenance is to keep the aircraft flying on a day to day basis in order to meet operational commitments.

Aviation Intermediate Maintenance Departments (AIMDs), which are located on aircraft carriers and amphibious helicopter ships, perform I-level maintenance for deployed squadrons. AIMDs are also located ashore at Naval Air Stations (NASs). AIMDs can perform repair on degraded components, which are then either returned to the squadron to complete repairs on an aircraft or put back in the stock of the local supply department. AIMDs perform repairs that

are beyond the capability of the O-level in order to keep aircraft operational availability high.

D-level maintenance is performed on NRFI components at DOPs. D-level facilities have more advanced capabilities than AIMDs and perform repairs, overhauls, and calibrations on components that have been inducted into the repair process.

Maintenance codes identify the authorized level of repair for a specific component and are found on the Allowance Parts List for that component. If a component is not authorized for repair at the O or I level, then it is considered a Depot Level Repairable (DLR) and must be repaired at the D-level. When a NRFI component is removed from an aircraft and identified as a DLR, it must be routed to the DOP for repair.

3. Component Induction Forecasting

NAVICP-Phil uses condition codes to identify a component's readiness for issue and current maintenance status. Condition codes that are most relevant to this research are as follows:

1. A Condition - indicates a component is ready for issue (RFI) and in serviceable condition.
2. F Condition - indicates a component is not ready for issue (NRFI) and requires repair.

3. M Condition - indicates a component is undergoing repair or reconditioning.

4. G Condition - indicates a component is not in the repair process but awaiting parts or awaiting induction following the receipt of all required parts.

When a DLR fails in the fleet, its condition code changes to F condition and it is routed to the appropriate DOP. Usually, the component is placed in storage at the DSP until such time that the component is identified for induction. When demand warrants returning the F condition unit to A condition, the component is then inducted into the repair process at the DOP.

NAVICP-Phil maintains inventory visibility of all components, regardless of condition code, and uses this information to determine demand on families of components and to forecast induction requirements. NAVICP-Phil must manage the pipeline of NRFI and RFI components to ensure fleet requirements are met and also provide accurate forecasts to the DOPs for advance workload and resource planning. Failure to provide accurate forecasts results in inefficient utilization of resources, increased component RTAT, greater pipeline inventory investment requirements, increased component repair costs, and decreased fleet readiness.

Induction planning starts with a Component Repair Conference (CRC) attended by NAVICP-Phil, NADEP NI, and Naval Aviation Depot Operations Center (NADOC) and allows negotiations for induction requirements. This conference is held semiannually with a goal of forecasting induction requirements in order to meet fleet requirements for high demand critical components, leveling workload requirements for the DOP, and allowing more efficient use of resources by the DOP. NAVICP-Phil Inventory Managers estimate quarterly production requirements by factoring in current inventories of NRFI and RFI components, production lead-time, and fleet demand for that particular component. These preliminary requirements are provided to NADEP NI prior to the CRC. NADEP NI planners and estimators examine the proposed workload requirements with the respective repair shops to determine if NADEP NI has the capacity and resources available to meet NAVICP-Phil's repair requirements. Actual component inductions are then negotiated at the CRC with a goal of balancing repair requirements, DOP plant capacity, resource availability and utilization, and NRFI carcass availability. The CRC's goal is to produce a firm induction schedule for the next two quarters.

There is a second scheduling process called B08 scheduling and it is calculated on a weekly basis. This

process is intended to rectify unexpected inventory shortages that emerge from higher-than-expected demand, fill DOP excess capacity, resolve NRFI carcass availability problems, and accommodate rework requirements. This system solves short term scheduling problems by filling DOP capacity deficiencies, shifting workload requirements to offset NRFI carcass shortages, and to meet unanticipated demand. It also allows component surveys to be factored into the scheduling equation.

It should be noted that historically, the CRC has focused on only the next two quarters for induction forecasting. As discussed in Chapter II, MRP II requires a planning horizon greater than the longest material lead-time. For this reason, the CRC is expected to transition to an eight-quarter forecast. The ability to execute this transition so that the variability of an eight-quarter forecast is sufficiently low in order to allow accurate material planning is critical to the success of MRP II at NADEP NI.

B08 scheduling is conducted unilaterally by the DOP with NAVICP-Phil's permission in order to allow induction requirements to be modified from CRC decisions based on the availability of more recent and accurate information. The DOP has the latitude to induct components if it has

available capacity, the need for that component exists, and there are available NRFI carcasses available.

4. Material Planning

As discussed in Chapter II, material planning in the component repair process is critical to successful implementation of MRP II. In order to accomplish this, it is necessary to evolve the material planning philosophy from that of evaluating demand history of repair parts to estimating part requirements based on forecasted inductions. However, prior to reaching this step, it is necessary to analyze every component in order to determine the probability that a part will require replacement during the repair process. The Bill of Material (BOM) is utilized for this purpose.

A BOM lists the complete array of parts requirements for a particular component and includes such information as parts listed by Navy Item Identification Number (NIIN), part name and number, cognizant symbol (COG), unit of issue (UI), units per application (UPA), and price. A BOM is constructed from information available from numerous sources. These sources include the Master Data Record (MDR), the Illustrated Parts Breakdown (IPB), and Logistics Engineering Studies (LES) and they allow the component's parts breakdown structure to be identified and documented so

that all parts and subassemblies are identified on the BOM. NADEP NI uses North Island BOM (NIBOM) as their local software program for constructing BOMs and managing the database. A sample BOM taken from NADEP NI is provided in Appendix A.

As indicated in Chapter II, the component repair process involves rebuilding and repairing DLRs vice manufacturing a unit from scratch. A manufacturing BOM would need no additional information than that identified above. However, when a component is repaired or overhauled, only those parts that are considered broken or degraded are replaced. For this reason, additional information must be included on the BOM for utilization by the DOP in the repair process. Every part listed on the BOM has a calculated replacement factor (RF) that represents the probability that the part will need to be replaced during the repair process. This factor is determined from historical repair records for that component and from demand history for the individual parts. The RF is critical for accurate material planning and represents a potential source of variability.

RFs are calculated in NIBOM and are determined from historical data on the component. The data in NIBOM is obtained from the NAVAIR Industrial Material Management System (NIMMS). The resulting RF is included on the BOM for

each individual part. NIBOM history is built from records of material that is received by the DOP or completed requisitions. If there are long lead-times for a specific part, NIBOM's historical records would not reflect those items that are still outstanding, and therefore data would be skewed and could mask serious material problems. For this reason, a manual RF supercedes a calculated RF in order to counter any serious material availability problems that are not captured by NIMMS. Usually, the artisan is responsible for providing this information to the BOM manager.

Since the BOM is the primary tool for estimating material requirements to support a quarterly workload schedule, BOM accuracy is critical to ensuring adequate material availability to support the repair process. BOM accuracy is measured in terms of range and depth. BOM range determines the accuracy of the BOM in terms of whether a part required for component repair is listed on the BOM. This is a function of the completeness of the initial BOM construction and the effectiveness of a quarterly review of parts that are candidates to be added to the BOM.

A second BOM accuracy measurement is BOM depth. Depth is a measurement of the RF accuracy. The RF is updated on a quarterly basis and the delta between the current quarterly

RF and the historical RF is tracked. RF variability of less than ten percent is considered the benchmark for NADEP NI performance standards. If the RF varies by more than ten percent, investigation is required to determine if there might be an error in recorded information on the BOM that would cause large variation in the calculated RF. A common cause of RF variability is an error in the UPA that causes more or fewer parts to be replaced than indicated by the RF.

Total BOM accuracy is a product of BOM Range Accuracy and BOM Depth Accuracy. A BOM with a range accuracy of 0.9 and a depth accuracy of 0.9 would have an overall BOM accuracy of 0.81.

5. Component Processing Practices

Based on the CRC quarterly component induction schedule, NADEP NI develops a weekly induction schedule that accounts for production requirements, plant capacity, resource availability, and available NRFI or F condition carcasses. Components are inducted from the pool of F condition DLRs that are stored at the DSP. The fleet supplies the F condition pool when failed components are routed to the DSP to await induction into the repair process.

When inducted, the component is routed to an artisan who inspects the component and determines if the component

can be repaired. If it is beyond repair, it is surveyed. If it can be repaired, the artisan determines the parts necessary to complete the repair. The artisan can acquire parts from NADEP NI's Focus Stores, which provides a readily available inventory of common parts. If the required parts are not available, then the remaining required parts are requisitioned based upon information on the BOM. The component is placed in a delay status and routed to Production Control for stowage until the required parts are received. When the parts are received, they are matched to the appropriate component and routed back to the artisan for repair. If the parts have an estimated shipping date (ESD) more than 45 days in the future, then Production Control takes action to transfer the component to G condition.

When a component is placed in G condition, the RTAT is interrupted and the time spent in G condition does not count against NADEP NI performance measures. The component is placed in G condition stowage in FISC SD's G-Stores until the required parts are received.

While in G condition, a component is classified as Awaiting Parts (AWP) as long as there are outstanding parts requisitions for that component. Once all parts are received and matched to the appropriate component, the component is not automatically routed back to the NADEP NI

repair shop. Instead, it is classified as Awaiting Induction (AWI) and will remain in G-Stores until NADEP NI requests for re-induction. This allows the cognizant shop to manage their workload and not induct components before resources are available to complete the repair. It also ensures NADEP NI's RTAT clock does not resume until the shop is ready to complete repairs.

When a part is inducted and the appropriate shop completes repairs, the unit's condition code is updated to A condition and it is routed to the DSP where it will ultimately be routed to a stock point designated by NAVICP-Phil. The unit is now available for issue to the fleet.

C. UAMOC BUSINESS PRACTICES

This section examines the component repair practices employed by United Airlines Maintenance Operations Center at San Francisco International Airport.

1. Organizational Responsibilities

United Airlines utilizes two levels of maintenance: organizational and depot level. UA operates maintenance facilities that include domestic line maintenance activities in Denver, Chicago, Los Angeles, and New York. UA also operates depot level activities in Indianapolis and San Francisco. San Francisco is the primary overhaul point for

repairable components. UAMOC is responsible for managing approximately 20,000 line items, which UA calls "recoverables". Roughly 80 percent of the recoverables that are repaired at UAMOC are used for inventory replenishment while the other 20 percent are used directly in aircraft overhaul processes.

A recoverable is assigned a Home Shop, which has overall responsibility for repair and overhaul of that line item. The Home Shop can either repair the unit in-house or outsource the repair to an outside vendor or to the original equipment manufacturer.

The Home Shop is also responsible for setting inventory levels for all cognizant recoverables by determining a Maximum Spares Allocation (MSA). By setting the MSA for the total system inventory levels, the Home Shop is capable of planning repair resource requirements based on the estimated number of recoverable repairs required to meet the MSA.

UAMOC inventory managers are co-located with and report to the same manager as the component shop personnel. Both work toward the common goals of meeting established system inventory levels, reducing overall TAT, and attaining organizational cost objectives. TAT as tracked by UAMOC is the total time it takes to return a recoverable to RFI condition.

The close working relationship between inventory managers and repair personnel allows rapid response to changes in system requirements by adjusting inventory levels in response to increased demand. The ultimate goal is to reduce TAT. This arrangement facilitates that end.

2. Component Repair Scheduling

Since both the Inventory Managers and repair shop personnel work in the same organization and work toward the same goals, there is no need to negotiate the quantity of components to be repaired in a given period. The goal is to meet the required MSA and to reduce TAT in order to ensure recoverables are available to meet depot and line needs.

When a recoverable fails on an aircraft, the line activity removes and replaces that component and routes the NRFI unit back to the Home Shop in accordance with UA guidance. At this time, the line activity also enters the information into UA's System Inventory Priority (SIP) database. The SIP produces a report that allows the Home Shop to manage recoverable repairs and workload. The SIP identifies all recoverables in the repair pipeline by part name and number, quantity needed for repair that day, MSA, total units available in RFI condition, flight criticality code, and a value-added factor. This factor weights asset availability, airframe application, and the revenue

generation for the route of that type of aircraft. This is the primary means of prioritizing repairs for recoverable components. The greater the impact a component has on revenue generation, the higher the priority it receives on the SIP. Since RFI/NRFI inventory levels are updated daily in the SIP database, the value-added factor for a recoverable in the repair pipeline is in constant flux. The priority will continue to shift until the recoverable is inducted into the repair process. At this time, the priority is locked. From this point on, all recoverables in the repair shop are handled on a First-In, First-Out (FIFO) basis.

If the recoverable urgency of need changes from the priority given on the SIP after it is inducted, expediting is accomplished through personal intervention by repair shop personnel, supervisors, and managers. This becomes necessary when an aircraft is grounded or an overhaul process is being held up due to parts shortages.

Parts required to complete component repair are drawn from UA's stores inventory and available parts are turned over to repair shop personnel. If parts are not readily available, then stores personnel take action by locating the part from another UA shop, another airline, or by initiating a procurement from a vendor or manufacturer. The component

is then placed in a delay status called "Held Out of Service" until all parts necessary for the repair are received. Lead-time for parts is rarely more than two weeks. In the meantime, the repair technician goes to the next component on the priority list using FIFO.

All NRFI recoverables are stored in the Home Shop and have visibility on the SIP report and all recoverables will enter the repair process eventually. The priority given on the SIP determines a components relative position in the queue and when it will be inducted into the repair process.

3. Incentives and Performance Measures

UA is an employee-owned company. Employees own 51 percent of the airline and are offered an employee stock option plan. There is frequent and widespread education throughout the organization to ingrain the relationship between TAT and pipeline inventory and the ramifications of these on costs. An indication of the relative importance that UAMOC places on this relationship is the fact that computer screen-savers espousing this relationship are found throughout the UAMOC facilities. Inventory reduction is considered necessary to reduce costs and to ensure UA remains competitive within the airline industry. And this is critical for employee job security and for maintaining an individual's standard of living. For this reason, inventory

and TAT reduction are primary goals for the organization and all employees within UAMOC.

D. COMPARE AND CONTRAST OF THE PROCESSES

Figures 3-1 and 3-2 are diagrams of the organizational structures employed at UAMOC and at NADEP NI.

Figure 3-1 shows the component repair process flow at UAMOC. It is a highly compact process with multiple responsibilities centralized within a single organization. Of particular interest is the fact that inventory management, component repair, and material procurement are in the same organization. This arrangement is congruent with the goal of reducing TAT. All three functions are managed centrally and judged by their contribution to reducing TAT and component inventory.

Figure 3-2 shows the component repair process of which NADEP NI is a part. It details a complex arrangement of organizations, each with multiple customers and suppliers in the value chain. Unlike UAMOC, all of the key functions in the Navy process are assigned to separate organizations, each receiving their funding from, and reporting to, a different superior. These organizations (NADEP NI, DLA, and NAVICP-Phil) have widely differing measures of success, which reward different behaviors. It highlights the fact that NADEP NI is highly dependent on external activities for

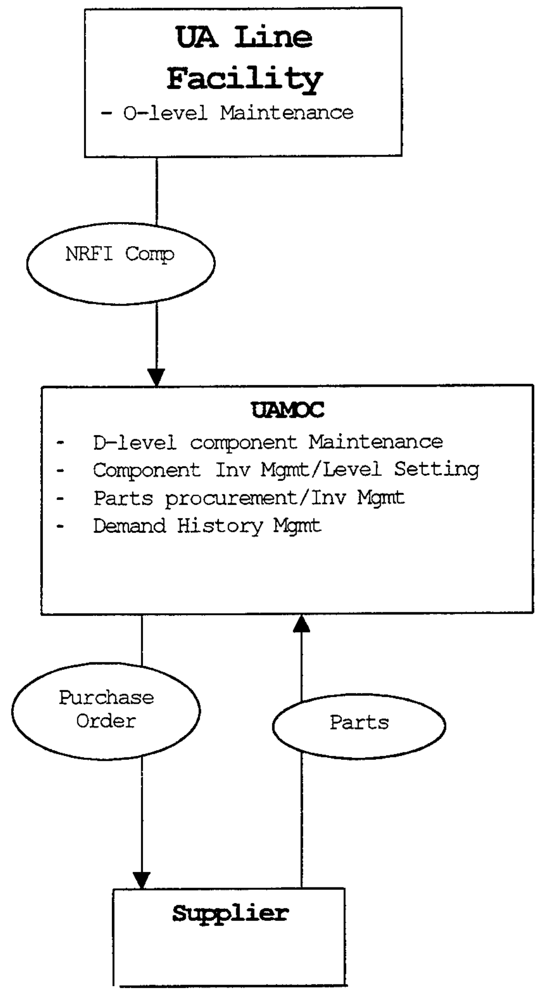

Figure 3-1. UAMOC Component Repair Process Flow

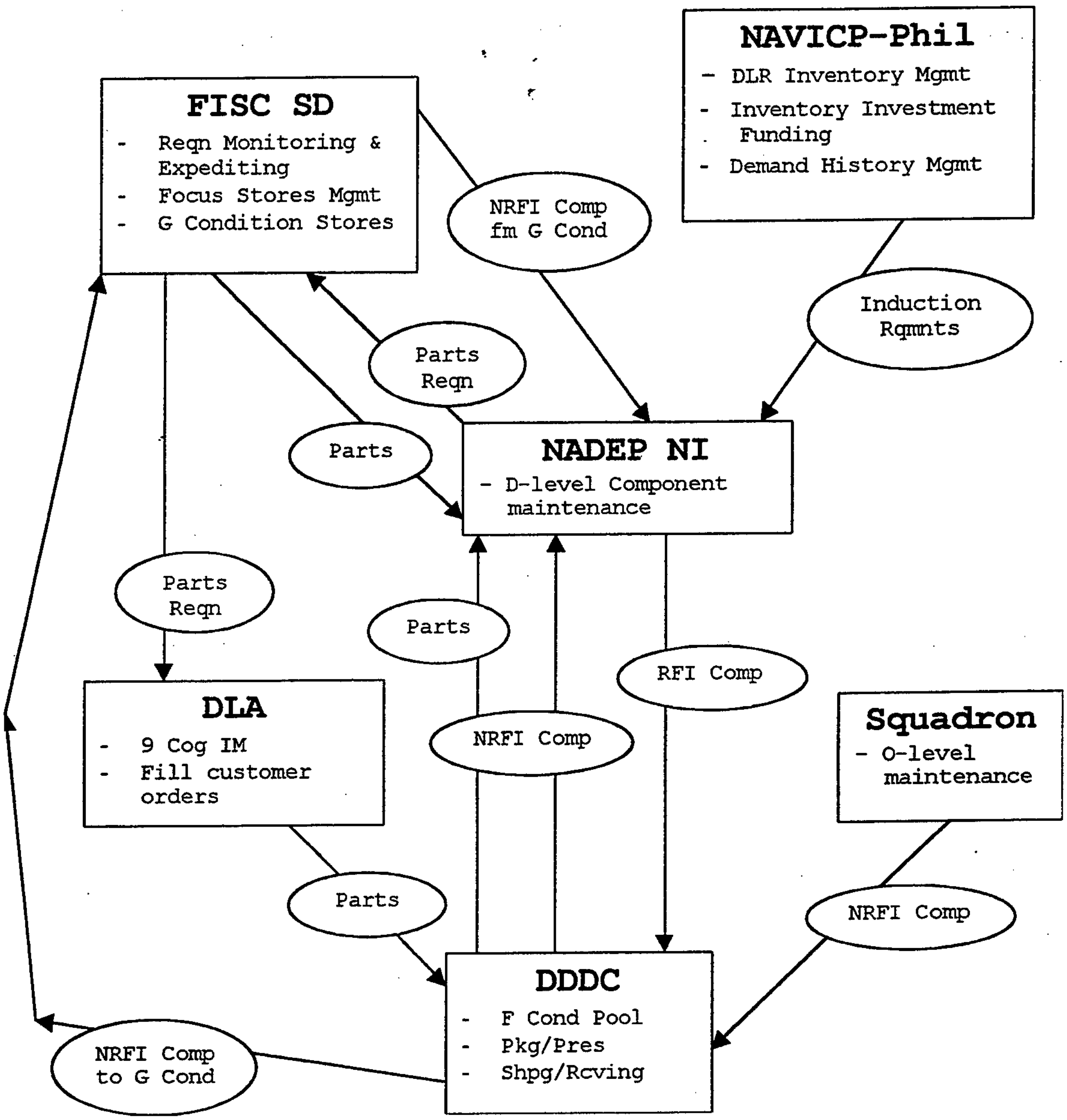

Figure 3-2. NADEP NI Component Repair Process Flow

the success of the component repair process. If these organizations are not rewarded for the same outcomes or judged by the same performance measures, then NADEP NI's energy is spent trying to overcome these barriers.

A major difference between the two processes is the relative importance each places on TAT and inventory reduction. As discussed previously, UAMOC places great emphasis on TAT for the organization and educates all employees on its importance and its impact on operations. In addition, UA employees recognize the impact on them, as individuals since the organization is 51 percent employee-owned. There is little evidence of recognition of the relationship between TAT and component pipeline inventory levels at NADEP NI.

While UAMOC tracks total TAT closely, NADEP tracks RTAT. TAT considers the total time that a component is not available for issue, while RTAT only considers the time the component is in the repair process. The time spent in G condition does not count against NADEP NI's RTAT. There is little incentive to get an item out of G condition as long as there are other NRFI components to repair. There is little emphasis placed on expediting the parts required to repair the components. Consequently, components languish in G condition for excessive periods of time waiting for the

supply system to provide the required parts. The longer TAT requires higher component pipeline inventory levels in order to satisfy fleet demand.

In Figure 3-1, UAMOC's inventory managers and component repair personnel are part of the same organization and report to a common manager. This arrangement is in stark contrast to the system employed by the Navy where NADEP NI provides the repair services for components that are owned and managed by NAVICP-Phil. In addition, another organization (DLA) provides the parts needed to repair the components. Individuals within these organizations are not impacted by TAT issues and have little incentive to reduce TAT and pipeline inventory.

Another difference between the two organizations is the way components are selected for repair. At UA, every failed component is placed on the SIP and enters the repair pipeline. The assigned repair priority determines when a particular component is actually inducted for repair, but every component on the SIP will be repaired. This contrasts sharply with the Navy practice where a NRFI component is routed to the DSP where it sits in F condition inventory pending a negotiated agreement between NAVICP-Phil and NADEP NI to induct the unit for repair. Units may stay in this status for a prolonged period due to resource and capacity

constraints, insufficient demand, or oversupply of NRFI units.

Because of the differences in missions, it is not feasible to consolidate the Navy organizational structures shown in Figure 3-2 in order to make them look more like the UAMOC structure shown in Figure 3-1. However, it is possible to make the two processes behave more alike by changing the reward structure among the various military organizations that contribute to the process. By measuring each activity's contribution to TAT and component inventory reduction, the behaviors needed to reach those goals would be reinforced, including fostering a closer working relationship and more communication between the repair organization, inventory managers, and piece-part managers. This modification would require enormous commitment on behalf of these organizations and their reporting seniors. It would involve significant risk sharing which places trust and reliance on external organizations in the pursuit of performance goals. However, organizational behavior cannot be changed without a modification to the rewards and incentives for the organization and the individuals within the organization.

IV. SELECTION OF REPRESENTATIVE COMPONENTS

A. INTRODUCTION

This chapter outlines the components utilized in this research and identifies the selection criteria for those components. There are approximately 3,500 total components that comprise NADEP NI's active workload, however they do not all equally contribute to revenue generation relative to total component workload.

B. COMPONENT CATEGORIES

Components are categorized into Family Identification Codes (FIC). FICs represent components with similar designs and part requirements, and serve identical or slightly modified end-uses or applications. They also have similar repair requirements and workload standards for NADEP planning purposes.

Within FICs, components are further classified into Item Identification Codes (IIC). Components within the same FIC but with different IICs usually represent slightly different designs, either through modifications to the existing engineering drawings or through original engineering designs that may vary slightly but serve the same application. Each IIC is generally assigned its own

NIIN and receives individual inventory management attention from NAVICP-Phil. However, different IICs within the same FIC generally have the same unit price and the same workload standard for NADEP NI resource planning purposes.

C. COMPONENT WORKLOAD ANALYSIS

NADEP NI tracks the revenue generation of the active component workload. Of the 3,500 component IICs in NADEP NI's active workload, 458 IICs account for 80 percent of the revenue generated from NAVICP-Phil scheduling component workload at NADEP NI. In Fiscal Year (FY) 1997, NADEP NI's component workload was valued at 175 million dollars. Based on this, the top 80 percent of revenue generators account for 140 million dollars in workload.

Since this grouping accounts for the largest percentage of revenue generated in NADEP NI's component repair processes, these components are targeted for research analysis.

The 458 IICs are grouped into 260 FICs. Since the majority of component data at NADEP NI are tracked by FIC and not by IIC, component research selection is based on FIC. The complete listing of the 260 top revenue generating FICs are found in Appendix B.

A ten-percent sample of the 260 FICs is selected and identified in Figure 4-1. The components selected vary in

characteristics with respect to responsible repair shop, quarterly RFI completions, aircraft applicability, workload labor standards, unit prices, and quantities in G condition.

FIC	COG/NSN	PART NAME	UNIT PRICE ($)
280A	7R 5841-00-119-4525	Receiver	211,660
5QQA	7R 1620-00-617-9551	Strut	101,170
A4XA	7R 1680-01-154-7535	Trim Actuator	35,690
A607	7R 5815-00-116-7532	Keyboard	44,040
AEG6	7R 4810-00-021-6755	Valve, Elec-Hyd	4,460
ARWA	7R 6615-00-757-5816	Gyroscope	4,120
B1FA	7R 5985-00-895-1002	Ant-Trg	77,430
BAR7	7R 2925-00-134-0130	Starter-generator	7,670
BS5A	7R 1270-01-334-8678	Computer	64,030
C6PA	7R 6130-01-348-1008	Power	2,010
C800	7R 6620-00-755-7169	Flow Transfer	3,350
E1RA	7R 1650-00-442-8061	Hydraulic Motor	71,640
FQAA	7R 1560-01-125-8000	Aileron	47,700
FRSA	7R 1680-00-631-9680	Drive, con	79,420
G4VA	7R 1650-00-688-8478	Actuator, electro	104,400
GRUA	7R 1560-01-148-9829	Stabilizer, Horiz	62,080
HBPA	7R 6115-01-119-0648	Generator	44,100
JAJ9	7R 1560-00-245-3022	MLG Door	64,030
KF86	7R 6605-00-294-8890	Indicator, Attitude	28,810
MHBA	7R 1620-00-969-9467	Steer-Dmp	16,870
P1Y0	7R 1650-01-125-7196	Slv Xdcr	4,050
PK86	7R 1650-01-113-6033	Damper-cyl	15,710
PWC4	7R 4320-01-131-1435	Pump axial	27,100
PXBA	7R 1560-00-942-8197	HK-E2-Shnk	7,280
Q2H4	7R 1650-01-177-1963	Servo Valve	33,710
Q4V7	7R 1620-01-191-5694	Strut	391,470

Figure 4-1. Components Selected For Analysis

The sample is reviewed for adequacy of representation of the population of components repaired at NADEP NI. The avionics, instruments, hydraulics, and electric repair shops are represented in the sample. Quarterly RFI credits range from zero for FIC Q4V7 to 61 for FIC PWC4. Aircraft applicability includes S-3s, E-2s, F-14s, and F/A-18s. The

workload standard, which determines the rate at which NADEP NI generates revenue, ranges from five hours for FIC P1Y0 to 232 hours for FIC GRUU. Component unit prices range from about 2,000 dollars for FIC C6PA to nearly 400,000 dollars for FIC Q4V7. The components also vary in the degree of material problems encountered as indicated by the G condition inventory levels. These range from 80 for FIC P1Y0 to zero for multiple FICs. Based on a cursory review, the sample is considered representative of the population of components that NADEP NI is responsible for repair.

V. DATA ANALYSIS

A. OVERVIEW

This chapter analyzes data collected at NADEP NI with respect to variability in the material planning aspect of the component repair process. As discussed in Chapter IV, 26 components are selected for analysis. Forecast accuracy, BOM accuracy, and material lead-time data are analyzed separately in order to make inferences about NADEP NI's ability to reap the benefits of implementing MRP II.

B. COMPONENT INDUCTION FORECAST ANALYSIS

As discussed in Chapter III, NADEP NI component induction forecasts are developed for two quarters in a three-tiered process. The process starts with NAVICP-Phil providing preliminary requirements and then revised forecasts to NADEP NI. Forecasts are finalized at the CRC where NADEP NI and NAVICP-Phil negotiate the final induction levels for the next two quarters. Appendix C contains the NADEP NI Quarterly Component Production Reports for first quarter FY 1998 (julian dates 7271 through 7361) and second quarter FY 1998 (julian dates 7362 through 8087). These reports show the forecasted values for component inductions by FIC. The preliminary forecasts represent the initial

forecasted requirements provided by NAVICP-Phil. The "ICP Req" column represents NAVICP-Phil's revised forecast and the "Prod Req" column indicates the final negotiated induction quantities agreed to by NAVICP-Phil and NADEP NI. The column titled "RFI" documents the number of components that were returned to A condition and is the basis for measuring NADEP NI's production. NADEP NI receives revenue only for completed components.

Appendix D contains data analysis tables for quarters one and two as taken from the Quarterly Component Production Reports. Three different relationships are analyzed in the Appendix D tables: NAVICP-Phil Preliminary Forecast versus actual number of components returned to RFI condition; NAVICP-Phil Revised Forecast versus actual number of components returned to RFI condition; and CRC Negotiated Workload versus actual number of components returned to RFI condition. Each are analyzed to reflect the percent variation from the forecast. The first quarter preliminary forecast variation percentage relative to RFIs completed for FIC 280A is shown below as an example.

$$\text{Pct Variation} = \frac{\text{ICP Prelim} - \text{RFI Comp}}{\text{ICP Prelim}} \times 100$$

$$\text{Pct Variation} = \frac{15 - 12}{15} \times 100 = 20\%$$

The percent variation is calculated using the absolute difference between the forecast and actual components completed in order to demonstrate total variability instead of net variability between high and low forecasts.

A review of the analysis indicates that the mean variation is skewed to reflect a value higher than is representative of the population of components. This is due to several components having excessively high forecast variation percentages. For this reason, the median is utilized for further analysis. Figure 5-1 summarizes the component forecast accuracy relative to actual RFI components completed for each quarter.

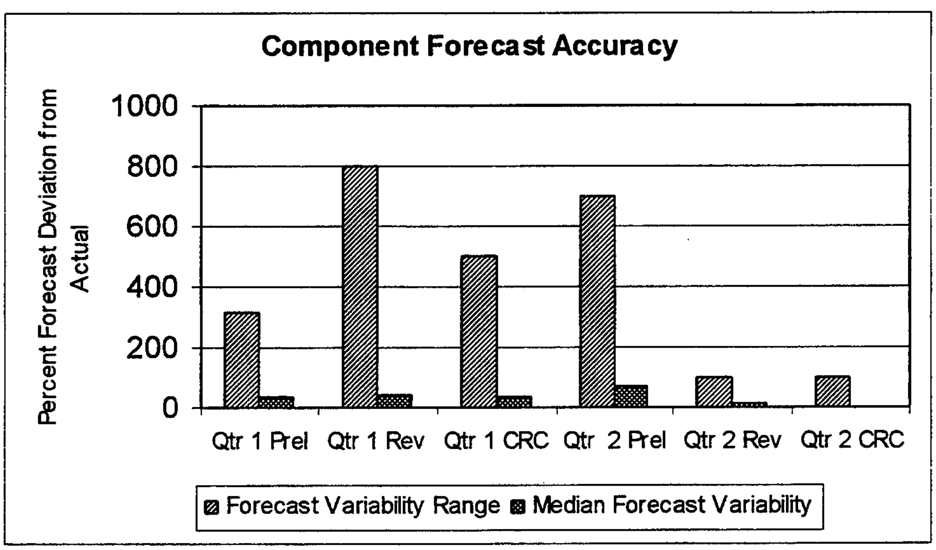

Figure 5-1. Component Forecast Accuracy

The range forecast variability bar indicates the range of forecast error relative to actual production for all sample FICs during the execution quarter. The median forecast variation bar indicates the median forecast error relative to actual production for all sample FICs during the execution quarter. In all cases, there is significant error in the forecast relative to actual RFI components completed. The median component variation ranges from 38 to 43 percent in quarter one. However, the variation ranges are 313, 800, and 500 percent for the preliminary, revised, and final negotiated estimates respectively. These numbers show tremendous error in each of the forecasts relative to the actual number of components completed.

Quarter two median variations are 74, 12, and zero percent for preliminary, revised, and CRC negotiated estimates respectively. But again, when considering the variation ranges of 700, 100, and 100 percent, there is still high variation in the forecasted component repairs versus actual repairs. This degree of forecast error will not allow accurate material planning and therefore will not support MRP II.

Forecasting component demand for military applications is a highly complicated process, which is subject to numerous external influences. The accuracy of the

component's stated reliability is the basis for initial spares allocation and the established maintenance concept. If actual reliability varies from the stated reliability, forecasted demand will be in error. In addition, the rate at which a component fails is highly dependent upon the environment in which the aircraft operates, mission profiles, and the operational tempo employed. Since these factors vary significantly from one deployment to another, the forces driving component failures and demand vary widely. These factors greatly complicate the ability of NAVICP-Phil to provide accurate component demand forecasts. Other factors impact demand, including DoD budgetary concerns and unanticipated contingency operations. These are factors that private sector organizations such as United Airlines do not have to contend with.

C. BOM DEPTH ACCURACY ANALYSIS

As discussed in Chapter III, Total BOM Accuracy is a product of BOM Range Accuracy and BOM Depth Accuracy. BOM Range Accuracy is not closely tracked at NADEP NI. NADEP NI estimates that BOM Range Accuracy is between 81 and 86 percent. However, since the validity of these accuracy rates could not be determined, range accuracy is assumed to be 86 percent.

Since BOM Depth Accuracy is a measure of the RF accuracy, this value is crucial to material planning in a repair environment. Appendix E contains Depth Accuracy values as tracked at NADEP NI for each of the 26 components. Accuracy rates are updated every quarter. The component inductions represent the total inductions since NIBOM data collection began. These values are weighted for component inductions for that FIC. The weighted BOM accuracy for FIC 280A is derived as follows.

$$\text{Weighted BOM Accuracy} = \frac{\text{FIC Comp Inductions}}{\text{Total Comp Inductions}} \times \text{FIC BOM Accuracy}$$

$$\text{Weighted BOM Accuracy} = \frac{42}{3311} \times 0.7924 = 0.0101$$

The accuracy measurements in Appendix E are weighted based on inductions for each FIC as a percentage of total components inducted for that quarter. Therefore, the sum of the individual BOM Depth Accuracy measurements provide the overall BOM Depth Accuracy at NADEP NI for the FICs selected. The BOM Depth Accuracy weighted average for the sample of components is 93.4 percent.

Figure 5-2 displays FIC BOM Depth Accuracy as a function of total FIC inductions. The data points are

plotted as a scattergraph using Microsoft Excel and a trend-line is added using the Excel chart trend-line function. A logarithmic trend-line superimposed through the data points results in a coefficient of determination (r^2) of 0.5453 and indicates a relationship exists between BOM Depth Accuracy and component inductions.

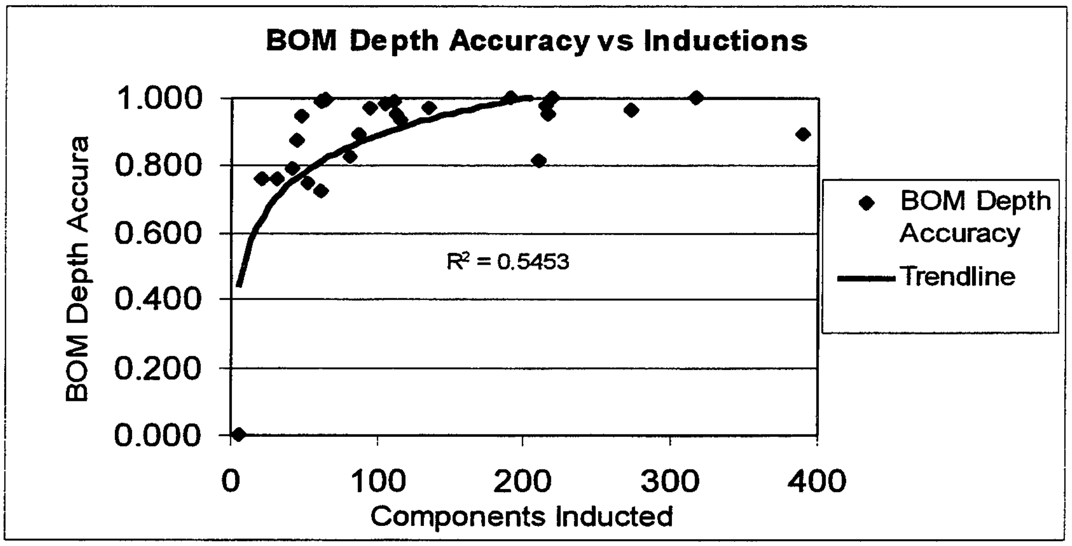

Figure 5-2. BOM Depth Accuracy Versus FIC Inductions

The trend-line indicates that depth accuracy improves as FIC component inductions increase. The author hypothesizes that this can be explained in part because as more components are inducted, part replacement data accumulates which tends to increase the accuracy of the RF. This would indicate that the variability associated with the

RF would decrease with time as component induction data accumulates.

Component configuration changes or engineering modifications would be expected to cause BOM accuracy to drop. However, accuracy measurements would be expected to follow the same trend described above until BOM accuracy reaches acceptable levels.

BOM accuracy is the basis for determining material requirements in the repair process. NAVAIR's corporate goal for Total BOM Accuracy is 95 percent. This accuracy level requires BOM Range Accuracy and BOM Depth Accuracy levels of 97.5 percent each. As discussed in this section, current BOM accuracy measurements are significantly below this level. With Depth Accuracy of 93 percent and estimated range accuracy of 86 percent, overall BOM accuracy is estimated to be 80 percent. This indicates that material estimates will have an 80 percent accuracy rate, which is unacceptable in MRP II. Figure 5-2 shows that this accuracy measurement is expected to improve as usage data accumulates. However, it cannot be determined from this data whether the accuracy rates will reach NAVAIR's stated goal of 95 percent.

Continued tracking and analysis of material usage data and the improvement of BOM accuracy rates must remain a priority at NADEP NI. Otherwise, material planning for

repair processes will be haphazard at best with significant error expected in the estimates.

D. REQUISITION LEAD-TIME ANALYSIS

Reliable OST for material requirements is critical to managing resource planning in MRP II. MRP II requires a planning horizon greater than the longest material lead-time. At NADEP NI, G condition components have the longest material lead-times and thus present a good opportunity to study lead-time issues.

Currently, material required for component repairs are requisitioned five weeks prior to the beginning of the execution quarter. When NADEP NI does not expect parts to be shipped for at least 45 days, components are transferred to G condition. As of 21 April 1998, there were 3,660 components in G condition representing 654 FICs. Of these components, 2,904 were in AWP status with outstanding requisitions for parts. Requisitions for parts against G condition assets are analyzed to gain an understanding of how requisition lead-time impacts the material-planning horizon at NADEP NI.

Appendix F contains an excerpt from a bi-weekly G Condition Status Report dated 15 May 1998. This report details every G condition asset and all outstanding

requisitions against that component. It is the source of requisition data for this research.

Appendix G summarizes the pertinent data from the G Condition Status Report for all sample FICs as of 15 May 1998, the date of the status report in Appendix F. The data used includes total number of components in G condition per FIC, all requisition julian dates for the FIC, and the age of each requisition. Many parts are ordered more than once for replacement in multiple components. The data in bold represents the oldest requisition for each different NSN on order.

Many G condition components within a FIC are awaiting the same parts. If the ages of multiple requisitions for the same part are averaged, the resulting calculation masks the true lead-time for a part. Since all parts are ordered under the same priority, newer requisitions will not be filled before the older requisitions. Therefore, it is more appropriate to look only at the oldest requisition for each part on order instead of an average of all requisitions for the same part.

Figure 5-3 shows the results of the analysis. There are 223 components from the sample FICs in G condition. 18 of the 26 sample FICs have at least one component in G condition and an average of 12 G condition components per

sample FIC. There are 433 total outstanding requisitions for an average of two requisitions per component. However, there are only 70 different NIINs ordered under the 433 requisitions. The oldest requisition for each of these 70 items are analyzed. These requisitions are identified in bold in Appendix G.

	Reqn Statistics
Sample FICs	26
FICs w/ G Cond Assets	18
Total Comp in G	223
Total Reqns	433
Reqns/Comp	2
Comp/FIC in G Cond	12
Total Parts Ordered	70
Oldest Reqn (days)	722
Newest Reqn (days)	32
Age Range (days)	690
Mean Reqn Age (days)	253
Median Reqn Age (days	219

Figure 5-3. Requisition Analysis Summary

Figure 5-3 shows that the requisition age for these 70 requisitions ranges from one month to nearly two years (32 to 722 days). The sample data distribution is pictured in Figure 5-4. It clearly shows that the older requisitions skew the mean age to the right. However, when using MRP II, unusually long lead-times cannot be treated merely as anomalies, but rather, they must be part of the planning horizon. As discussed in Chapter II, an accurate forecast horizon must extend to the longest material lead-time.

NAVAIR identified 98 percent inventory accuracy as a requirement for MRP II implementation. However, the author

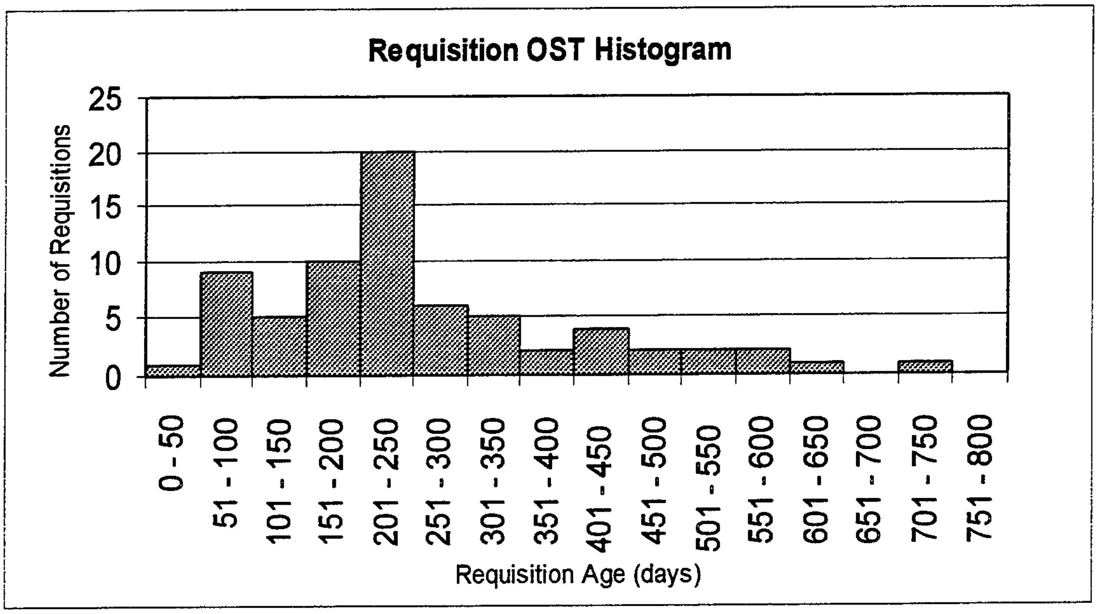

Figure 5-4. Requisition OST Histogram

believes this is a misnomer since a 98 percent inventory accuracy rate at NADEP NI will only ensure material availability if the material is carried at NADEP NI and in stock at the time it is needed. Inventory accuracy of 98 percent does not equate to material availability 98 percent of the time. Since many parts are not stocked locally, the author believes that a 98 percent material availability rate is more appropriate and is thus used as a benchmark to determine the effective material-planning horizon. This is more realistic as it considers delay time associated with requisitioning the required material.

To ensure 98 percent of the required material is available when needed, 98 percent of the 70 requisitions must be received when needed. 98 percent of the 70 requisitions rounds to 69, meaning that the planning horizon must extend to the 69^{th} requisition to ensure 98 percent material availability. The 69^{th} requisition is 616 days old. This represents a 20-month lead-time that must be factored into material planning in MRP II. This explains the perceived need to transition to an eight-quarter forecast. However, this approach may not be feasible.

It is highly unlikely that, given the dynamic military operating environment, an accurate forecast can be developed two years prior to the execution quarter. Therefore, it is appropriate to examine how the planning horizon can be reduced. In order to reduce the planning horizon, material lead-times must be reduced. Figure 5-4 shows that 14 of the 70 oldest requisitions recorded for the sample FICs are between one and two years old. These account for 20 percent of the G condition requisitions. Table 5-5 provides the value of the components that have been in G condition for at least one year.

These ten FICs account for 34 components that have been in G condition for at least one year. When considering all components from the 26 sample FICs in G condition, these 34

represent 15 percent of the total G condition population (223). Therefore, by solving material availability problems on 15 percent of the G condition components, the forecast horizon is reduced from two years to one year, or by 50 percent. In addition, this action will reduce work-in-process inventory by 2.3 million dollars for the 26 sample FICs and greatly reduce component TAT.

FIC	Qty in G Condition	Unit Price ($)	Total Value in G Cond ($)
5QQA	5	101,170	505,850
AEG6	1	4,460	4,460
E1RA	9	71,640	644,760
FQAA	1	47,700	47,700
HBPA	1	44,100	44,100
KF86	2	28,810	57,620
P1Y0	2	4,050	8,100
PK86	10	15,710	157,100
Q2H4	1	33,710	33,710
Q4V7	2	391,470	782,940
Total	34		2,286,340

Figure 5-5. Value of Components in G Condition One Year or More

E. SUMMARY

The analysis presented in this chapter clearly shows that there is significant variability in the material planning process. The variability is found in forecast accuracy, material estimating as measured by BOM accuracy, and in material lead-time. Current variability in the these

areas make accurate material planning a very difficult process in the military environment. In the author's opinion, due to the dynamic operating environment of the military, there is a degree of inherent variability in material and resource planning that cannot be eliminated. Therefore, the Navy will not be able to achieve Class A implementation status as discussed in Chapter II. At best, the repair process will be able to achieve Class C and possibly some degree of Class B implementation.

As the Navy already has significant time and resources committed to MRP II implementation, the issue is how to reduce the variability in order to maximize the Navy's potential benefit from MRP II implementation. This issue is addressed in the recommendations in Chapter VI.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

The data and information presented in this research regarding the suitability of the component repair process to the implementation of MRP II is sufficient for use in drawing conclusions and generating recommendations for management actions. This final chapter ends with recommendations for future study.

As discussed in Chapter V, it is the author's intention to provide constructive recommendations that will improve the material planning process and strengthen the benefits to be derived from MRP II implementation.

B. CONCLUSIONS

1. Within the Navy's aviation repair structure, there are critical differences in performance incentives and reward structures for inventory management, component repair, and parts procurement activities that could preclude the realization of intended benefits from MRP II implementation.

Ineffective material planning causes longer component turnaround times (TAT) and increased work-in-process

inventories. NADEP NI, NAVICP-Phil, DLA, and FISC SD each play critical roles in material planning for component repair. However, reward structures for these activities do not focus on reducing component TAT. NADEP NI could achieve a short repair turnaround time (RTAT) despite a delay caused by components waiting on parts for prolonged periods. This occurs because the delay does not count against their performance standards. Also, DLA does not measure the impact of requisition lead-time on customer production. Each organization must link TAT to component inventory levels and measure the impact of their contribution toward that end. Unless this relationship is emphasized and all activities reward the appropriate behavior, NADEP NI's production planning will remain reactive to short-term fluctuations in component demand.

2. The lack of a reliable component induction forecast is a major barrier to accurate material planning in a military aviation component repair environment.

The dynamic military operating environment makes predicting future demand inherently difficult. Therefore, forecast reliability increases with a shorter forecast horizon. Since MRP II requires a forecast horizon greater than the longest material lead-time, reducing material lead-time is paramount to reducing the forecast horizon. In

addition, parts procurement must be initiated when the forecast is known and with sufficient lead-time to allow delivery in time to meet schedule production.

3. The use of Replacement Factors (RFs) in a repair process adds variability to material planning that is not encountered in traditional manufacturing processes.

The use of RFs introduces a fundamental difference in the intended application of MRP II. In a traditional manufacturing process, the parts needed to produce one unit are known with 100 percent accuracy. In the repair process, the RF introduces uncertainty to material planning. RFs are probability of need factors for replacement parts in the repair process. They are based on historical demand and are the basis for estimating the parts needed for future component repair. NADEP NI's current RF accuracy of 80 percent is unacceptable for accurate material planning.

C. RECOMMENDATIONS

1. The reward structure should be modified to promote communication and teamwork toward common goals at those organizations with a role in material planning for the component repair process.

The author recommends establishing multi-functional teams comprised of key personnel from each responsible organization. They should be empowered to identify and enact solutions to improve forecast accuracy and material availability with the ultimate goals of reducing TAT and component inventories. All personnel in those organizations should be educated on the importance of this concept and the role that each individual plays in achieving that goal.

2. The material lead-time should be reduced for those items that most persistently delay component repairs.

Since planning must be greater than the longest material lead-time, the current two-quarter forecast horizon is inadequate for material planning. However, it isn't feasible to expect sufficient accuracy from an eight-quarter forecast. Reducing lead-time on those items that routinely take longer than one year to acquire can reduce the forecast horizon from the planned eight quarters to four quarters and will reduce G condition inventories by 2.3 million dollars.

3. Material availability should be the primary focus in planning, not inventory accuracy.

Inventory accuracy does not guarantee material availability. Most of the material required for component repairs are not stocked locally. The current procedure of

initiating material procurement five weeks prior to the start of the execution quarter guarantees longer TAT, substantial G condition inventory, and reduced readiness for operating units. Assuming a four-quarter forecast, material procurement should commence four quarters prior to the requirement to ensure material is received when needed. Assuming this will reduce G-condition to less than 100 days, the savings from pipeline inventory reduction for the 26 sample FICs would reach 6.2 million dollars.

4. The forecasting process should be improved to provide better information for resource planning.

NAVICP-Phil should stress fleet input in forecasting component inductions so that the intensity and types of operations employed and their influence on component demand is considered. Variability can never be eliminated from military forecasts. However, since MRP II by nature is not demand-based, usage at the fleet level must considered in depth for the development of the most accurate forecast possible.

5. RFs should continue to be used and refined for accurate prediction of component material requirements.

Accurate RFs are essential for material planning in a repair job shop environment. Outstanding requisitions are

not reflected in the NIBOM demand history database, which is used to calculate RFs. NADEP NI and FISC SD should conduct in-depth analyses on outstanding aged requisitions to determine if manual adjustments should be made to those RFs to more accurately reflect the actual probability of replacement during a repair.

D. RECOMMENDATIONS FOR FURTHER STUDY

1. Four-Quarter Component Demand Forecast Model

A study of forecasting techniques to develop a model that will provide accurate forecasts of component repair requirements would be useful. Such a forecasting model would improve forecast accuracy over a broader horizon allowing more accurate material planning for the repair process.

2. Inventory Management Techniques For Improved Material Availability to Support Component Repair Processes.

A study chronic material availability problems with the objective of developing creative inventory management solutions would help ensure material is available when needed. Reducing lead-time in the hard-to-get parts will significantly reduce the planning horizon required and would benefit the overall repair process.

APPENDIX A. SAMPLE BILL OF MATERIAL

Bill of Material Report by IIC 4/23/98

C:QBS4 FIC:HE3A Rshop:93606 Cog:7R FSC:6610 NIIN:011428323 SMIC:DA Std UP: $31,810.00

art Nbr: 31103-A22A IPB: 05-20GCA-6 Nomen: COMPUTER

og	FSC	NIIN	Nomenclature	Part Number	Cage	UI	UPA	SMR CD	Unit Price Standard	Unit Price Surcharge	Net	Repl Factors Calc	Repl Factors Man	Repl Factors Prev
IZ	5331	00-263-8028	PACKING	MS29512-04	96906	EA	0		$0.03	$0.03	$0.00	0.00	0.00	0.00
IG	6695	00-350-7586	BEARING ASSY.	1625303-1	99251	EA	1		$6.13	$6.99	$0.00	0.01	0.00	0.01
IZ	5310	00-411-8492	WASHER	1603660-35	99251	EA	1		$0.34	$0.39	$0.00	0.05	0.00	0.05
IZ	5342	00-437-8691	MOUNT,RESILIENT	1622704-1	99251	EA	4		$28.42	$32.40	$0.00	0.05	0.00	0.05
IZ	3120	00-448-7391	BEARING,WASHER,THRU	1623464-1	99251	EA	2		$2.40	$2.74	$0.00	0.05	0.00	0.05
IZ	3120	00-448-7392	BEARING	1623464-2	99251	EA	4		$4.80	$5.47		0.00	0.00	0.00
IG	6610	00-477-7930	SHAFT & PIVOT ASSY	1622708-1	99251	EA	1		$60.60	$69.08	$0.00	0.03	0.00	0.03
IG	6610	00-477-7931	SCREW AND NUT ASSEM	1622249-1	99251	EA	1		$1,403.56	$1,600.06	$0.00	0.03	0.00	0.03
IZ	5365	00-489-8816	WASHER, RUBBER	1623262-1	99251	EA	2		$26.66	$30.39	$0.00	0.22	0.00	0.22
IN	5950	00-497-9006	TRANSFORMER	1623806-1	99251	EA	1		$129.24	$147.33	$0.00	0.06	0.00	0.06
IG	6610	00-531-8822	FRAME AND BEARING A	1622712-1	99251	EA	1		$511.32	$582.90	$0.00	0.02	0.00	0.02
IZ	5331	00-579-8108	PACKING	MS28775-111	96906	EA	0		$0.04	$0.05	$0.00	0.00	0.00	0.00
9Z	5305	00-582-9493	SET SCREW	AN565AC6L6	81352	EA	4		$9.97	$11.37	$0.00	0.00		0.00
9Z	5305	00-843-2841	SETSCREW	MS51021-1	96906	HD	0		$3.72	$4.24	$0.00	0.00	0.00	0.00
9G	6610	00-916-7447	PAD,TRANSDUCER	1604568-1	99251	EA	3		$1.32	$1.50	$0.00	0.04	0.00	0.04
9G	6610	00-916-9987	SHAFT ASSY	1623924-2	99251	EA	1		$545.07	$621.38	$0.00	0.05	0.00	0.05
9Z	3110	00-949-2040	BEARING	S2CEP35LD	40920	EA	1		$33.82	$38.55	$0.00	0.00	0.00	0.00
9Z	5340	00-959-4211	CAP, PROTECTIVE	813720-12	99251	EA	1		$2.81	$3.20	.02 $0.00	0.54	0.00	0.55
9G	6610	01-131-5714	ROD ASSEMBLY	1623998-1	99251	EA	2		$362.60	$413.36	$0.00	0.05	0.00	0.05
9G	6605	01-211-2793	ENCODER ASSY	1631716-1 6163	99251	EA	1		$7,745.97	$8,830.41	$0.00	0.01	0.08	0.01
1R	9999	LL-LM4-0705	DECAL	89771	91145	EA	0		$6.83	$6.83	$0.00	0.00		0.00
9Z	5330	LL-LP4-3594	SEAL TAMPER	1623342-1	99251	EA	2		$9.36	$10.67	$0.00	0.27	0.00	0.27

APPENDIX B. COMPONENTS RESPONSIBLE FOR NADEP NI'S TOP 80 PERCENT OF REVENUE GENERATION

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
1	013399259	MA6A	TD16	48	38	YES
1	013837736	MA6A	VAJ2	4	4	YES
1	012019601	MA6A	Q980	25	19	YES
2	013389696	MBJA	TD17	46	37	YES
2	013837761	MBJA	VAJ3	3	3	YES
2	012019639	MBJA	Q990	24	18	YES
3	012204768	GRMA	RQ45	196	133	YES 11/21/96
3	011547537	GRMA	QH89	4	1	YES 11/21/96
3	013437026	GRMA	T2W6	275	181	YES 11/21/96
4	007227084	Y0GB	C3A0	6	0	YES 11/21/96
4	001827733	Y0GB	G502	355	314	YES 11/21/96
4	009280072	Y0GB	EM37	334	303	YES 11/21/96
5	001129255	A4L6	A4L6	128	108	YES 11/21/96
7	011555728	KR3A	QBW5	208	119	NO
7	011258858	KR3A	PWV2	34	14	NO
8	011325865	P484	P484	104	76	YES 11/21/96
9	011520853	HCHA	QG96	107	48	YES 11/21/96
9	011520854	HCHA	QG97	28	19	YES 11/21/96
10	012328815	AE3A	RUQ4	376	333	YES 11/21/96
10	012429595	AE3A	RX25	6	6	NO
10	011136037	AE3A	PK90	22	16	YES 11/21/96
10	011351392	AE3A	PW97	2	1	YES 11/21/96
11	011133259	FRSA	PPF6	216	102	YES 11/21/96
11	006319680	FRSA	K7G6	1	0	NO
12	011249243	BB4A	PQ49	113	88	YES
13	011444269	JSLA	P7W2	74	57	YES 11/21/96
14	001792655	C3NA	FMX3	96	88	YES 11/21/96
14	001655838	C3NA	H3E6	764	723	YES 11/21/96
15	012789395	HFFA	SKE2	45	38	YES
15	011867881	HFFA	Q6E7	78	74	YES
15	011527087	HFFA	QHF3	18	0	NO
15	011708884	HFFA	QYH5	2	0	NO
15	013248752	HFFA	TFM6	68	35	YES
16	001592298	HQL2	HQL2	309	292	YES
17	012321229	RVX1	RVX1	302	279	YES
18	013036743	HBPA	U8U9	56	49	YES 11/21/96
18	011625000	HBPA	QM94	292	268	YES 11/21/96
18	011542567	HBPA	QG78	35	30	YES 11/21/96
18	011190648	HBPA	PPP1	7	6	YES 11/21/96
19	004458090	AW9A	G8B0	37	18	NO
19	013565287	AW9A	UAB7	73	37	NO
19	010330185	AW9A	LKK6	109	45	YES 11/21/96
20	000783348	HBVB	AUS7	11	7	YES
20	012015740	HBVB	RB68	32	25	YES
20	003288317	HBVB	J6D8	8	5	YES
21	006179551	5QQA	K2V7	61	43	YES
22	005386020	KX93	KX93	48	39	YES 11/21/96

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
23	009611691	HC3A	E0F8	288	279	YES 11/21/96
24	009868995	5DKA	E698	400	344	YES 11/21/96
24	001827698	5DKA	G4P9	120	117	YES 11/21/96
25	001167534	WCWA	A609	20	17	YES 11/21/96
25	008823103	WCWA	JC40	62	46	YES 11/21/96
26	013513373	HF2A	T3D2	187	114	YES 11/21/96
26	011708388	HF2A	QJA8	29	16	YES 11/21/96
26	011614420	HF2A	QJA7	1	1	YES 11/21/96
26	011257361	HF2A	P109	1	0	NO
27	000897912	CFVA	AXE9	98	76	YES 11/21/96
27	001688308	CFVA	G5S4	145	105	YES 11/21/96
27	011473098	CFVA	P479	145	59	YES 11/21/96
28	011506731	BS6A	QCH7	42	29	YES
28	011360866	BS6A	P8W1	1	1	YES
28	011440122	BS6A	P6V3	1	0	YES
28	011440121	BS6A	P6V2	1	1	NO
28	011440123	BS6A	P6W7	1	0	YES
29	006191673	HP05	HP05	159	116	YES 11/21/96
30	011520840	FPUA	QHA4	10	8	YES 11/21/96
30	011636069	FPUA	QND2	1	1	YES 11/21/96
30	013477867	FPUA	T0L5	3	2	NO
30	012133876	FPUA	RK22	63	33	YES 11/21/96
30	013833284	FPUA	VCL6	7	3	NO
30	013037683	FPUA	SV86	3	1	YES 11/21/96
30	011435746	FPUA	P662	4	2	YES 11/21/96
30	011468357	FPUA	P660	4	2	YES 11/21/96
31	013477866	FQAA	T0J7	7	5	NO
31	012133877	FQAA	RK23	63	30	YES 11/21/96
31	011636070	FQAA	QND3	1	1	YES 11/21/96
31	011520841	FQAA	QHA5	7	6	YES 11/21/96
31	013001618	FQAA	SV87	1	0	YES 11/21/96
31	013833294	FQAA	VCL9	5	3	NO
31	011581771	FQAA	P663	6	5	YES 11/21/96
31	011561137	FQAA	P661	1	1	YES 11/21/96
32	013574345	PQQA	UAG1	5	5	YES
32	013581161	PQQA	UAL8	4	4	YES
32	013432609	PQQA	T1S0	184	178	YES
33	012061331	6CXA	RFQ7	105	51	YES 11/21/96
34	005386027	2YNA	KX94	34	27	YES 11/21/96
35	010030803	3KMA	K346	397	346	YES
36	001222353	BCMA	KV90	1	0	YES 11/21/96
36	010144050	BCMA	K903	43	15	YES 11/21/96
37	013477869	GKTA	T5P0	3	1	NO
37	011581774	GKTA	QJG1	29	16	YES 11/21/96
37	011468361	GKTA	P9F6	5	3	YES 11/21/96
38	001525089	HTU6	HTU6	579	520	YES 11/21/96
39	012429594	AG7A	RX21	109	71	YES 11/21/96

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
39	011518137	AG7A	P649	24	20	YES 11/21/96
39	011403258	AG7A	PPM1	1	0	YES 11/21/96
40	012823598	SSW0	SSW0	75	68	YES
41	004338871	1X1A	KUV4	48	10	NO
42	008320935	5BFA	JF80	1	0	NO
42	004134976	5BFA	KS68	12	5	YES 11/21/96
42	010093123	5BFA	K8C3	45	26	YES
43	006302325	4TMA	KOR8	266	236	YES
44	001462214	HXG1	HXG1	35	30	YES 11/21/96
45	001151245	CHWB	6TD8	621	495	YES
45	001151248	CHWB	6SQ9	173	147	YES
46	004134978	2BNA	KS69	2	1	YES 11/21/96
46	010152497	2BNA	K8C2	46	24	YES 11/21/96
47	010041771	3JEA	K534	4	4	YES
47	010041772	3JEA	K535	5	4	YES
47	010127491	3JEA	LTJ3	53	43	YES
47	002747128	3JEA	KSL2	1	1	YES
48	011581773	GKRA	QJD1	25	10	YES 11/21/96
48	013159426	GKRA	STB5	1	1	NO
48	013480966	GKRA	T5R0	1	0	NO
48	011468359	GKRA	P9F4	3	3	NO
49	001462213	HXG0	HXG0	33	31	YES 11/21/96
50	010639553	5ANA	NN88	76	62	YES
50	010175231	5ANA	LCF3	7	5	NO
50	005227596	5ANA	KW20	5	4	NO
51	002453022	JAJ9	JAJ9	48	33	YES 11/21/96
52	011557014	G55A	QCN3	82	74	NO
53	010765218	AEXA	NSU1	43	36	YES 11/21/96
53	010527002	AEXA	L2W9	1	1	YES 11/21/96
54	011311435	PWC4	PWC4	274	245	YES 11/21/96
55	011402298	L5RA	QFA0	95	93	YES
56	004338870	1X0A	KUV3	40	14	NO
57	002452603	DL2A	JAH3	38	14	YES 11/21/96
57	011342326	DL2A	PU88	1	0	NO
58	001795086	A8TA	FMY8	191	182	YES 11/21/96
58	008872068	A8TA	D780	46	41	YES 11/21/96
58	000863840	A8TA	JYH4	52	50	YES 11/21/96
59	000872636	CHEA	AWF7	8	5	NO
59	000872632	CHEA	AWF6	23	19	NO
59	012265321	CHEA	RR84	176	149	YES 11/21/96
59	010251289	CHEA	LCV3	13	10	NO
59	010204215	CHEA	LFQ1	44	29	NO
60	010175386	DR4A	LCF2	66	57	YES
61	009428197	PXBA	ETJ4	317	177	
63	013833273	EBLA	VCL0	13	7	NO
63	013013241	EBLA	SV84	43	26	YES 11/21/96
64	010030960	6L6A	K488	125	113	YES

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
65	010045575	42JA	K6H5	72	68	YES 11/21/96
65	010118485	42JA	K951	95	92	YES 11/21/96
65	010390761	42JA	LV55	4	4	NO
66	010265516	K7Y1	K7Y1	50	32	YES 11/21/96
67	014080379	CASA	VRN4	2	2	NO
68	001164020	A6U5	A6U5	174	161	YES 11/21/96
69	008710592	D2V0	D2V0	251	163	YES 11/21/96
70	012265320	A54A	RR73	164	147	YES 11/21/96
71	012204746	GRUA	RQ36	5	2	YES 11/21/96
71	012204747	GRUA	RQ37	12	7	YES 11/21/96
71	011636075	GRUA	QNB9	4	1	YES 11/21/96
71	011821943	GRUA	Q5B2	2	0	YES 11/21/96
71	011839795	GRUA	Q5E8	1	0	YES 11/21/96
71	011821942	GRUA	Q5B1	2	0	YES 11/21/96
72	010127356	5CGA	LA78	5	4	YES 11/21/96
72	011289935	5CGA	PVA0	71	57	YES 11/21/96
73	001105664	UY6A	J236	94	61	YES
74	013833312	BHQA	VCM3	10	6	YES 11/21/96
74	012996782	BHQA	SV85	40	33	YES 11/21/96
75	009008194	MDRA	EBA1	40	0	YES 11/21/96
75	011290138	MDRA	P6B5	118	97	YES 11/21/96
76	012906517	R570	R570	283	197	NO
78	001174629	A7H8	A7H8	244	215	YES 11/21/96
79	012405562	G5YA	RW12	61	36	YES 11/21/96
79	011506719	G5YA	QCM3	92	33	YES 11/21/96
80	001618782	HW44	HW44	199	121	YES 11/21/96
81	002948890	KF86	KF86	135	103	YES
82	011415724	0N6A	QGB9	64	38	YES
82	010788742	0N6A	N0B3	14	7	YES
83	011520846	JW7A	QHH3	64	33	YES
83	011708379	JW7A	QSJ6	10	3	YES
84	010295038	3U0A	LJ02	46	39	YES
85	001506897	0AKA	HG24	8	8	NO
85	001067552	0AKA	JSP0	31	23	YES 11/21/96
85	010395020	0AKA	LJ92	91	53	YES 11/21/96
85	001341824	0AKA	KSB4	46	34	YES 11/21/96
86	013042152	LTCA	S358	57	48	YES 11/21/96
86	011190647	LTCA	PPN9	101	90	YES 11/21/96
87	013416041	PCNA	T2H8	121	118	YES
88	011542867	GQFA	QJA6	6	4	YES 11/21/96
88	011861672	GQFA	Q568	112	80	YES 11/21/96
89	002924779	FHQA	KC22	205	178	YES
90	011258013	P2M4	P2M4	42	39	YES 11/21/96
91	013181228	ER0A	S4A4	55	31	NO
92	010734475	0DXA	NTT1	21	14	YES
93	001679800	HE3A	BCJ7	14	11	YES 11/21/96
93	011428323	HE3A	QBS4	125	106	YES 11/21/96

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
94	001270242	5NNA	K4Q1	132	95	YES
95	000870629	KE2A	AWE0	47	43	YES 11/21/96
95	000985309	KE2A	A0V1	82	79	YES 11/21/96
96	013137374	C7WA	STB4	18	8	YES 11/21/96
97	011708280	MDBA	QVN1	196	169	YES
97	011708279	MDBA	QVN0	27	16	YES 11/21/96
97	011444413	MDBA	PWL9	71	67	YES 11/21/96
98	001473199	HTV1	HTV1	219	150	YES 11/21/96
99	011515805	A21A	P9P3	98	73	YES
100	006902038	JCF2	JCF2	98	65	YES 11/21/96
102	001194525	280A	A7Y1	12	6	NO
102	001389617	280A	KY25	30	19	NO
102	005124202	280A	KWH4	3	0	YES
103	001462172	AVBA	HW83	1	1	NO
103	010959170	AVBA	N733	27	16	YES 11/21/96
104	002453109	JAK0	JAK0	29	23	YES 11/21/96
105	013821500	VB88	VB88	40	19	NO
106	007805788	DC27	DC27	230	116	YES
107	002452601	C8MA	JAH2	24	9	NO
107	011336907	C8MA	PU87	1	0	NO
107	012537037	C8MA	R8Q0	2	0	NO
108	012653659	EXTA	R8W7	115	64	YES
108	011435941	EXTA	P610	13	7	YES
109	012643953	SAM6	SAM6	107	79	YES 11/21/96
111	001489231	KC96	KC96	19	12	YES 11/21/96
112	011771963	Q2H4	Q2H4	112	98	YES 11/21/96
113	009335950	J6LA	EPT4	16	9	YES 11/21/96
113	001655827	J6LA	HVW2	45	30	YES 11/21/96
113	005908270	J6LA	CDV7	92	78	YES 11/21/96
114	001345625	CR1A	LYA1	128	100	YES 11/21/96
114	010550468	CR1A	L5D5	42	31	YES 11/21/96
115	013160316	C79A	STB3	16	11	YES 11/21/96
116	013416039	6LEA	T2H7	23	16	YES 11/21/96
116	010538768	6LEA	L6T6	3	1	YES 11/21/96
116	011293569	6LEA	PYY6	56	32	YES 11/21/96
117	002814779	KKQ2	KKQ2	17	9	YES
118	009965278	A2MA	E9T8	14	10	YES 11/21/96
118	013705742	A2MA	U5B4	3	3	NO
118	012517201	A2MA	R2B3	1	1	YES 11/21/96
118	010439782	A2MA	LXT2	30	30	YES 11/21/96
119	004217726	HAT9	HAT9	168	149	YES
120	005674548	BA0A	K015	101	94	YES 11/21/96
120	011374682	BA0A	PYJ3	219	195	YES
121	012054796	N5LA	RTT1	61	41	YES
122	010228572	DD8A	K8F1	36	21	YES
122	010309464	DD8A	LGT2	9	4	NO
123	010164134	4AHA	K7Y7	19	3	NO

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
123	010146964	4AHA	LA34	1	1	NO
124	001101748	JYM4	JYM4	113	90	YES
125	012423760	NRWA	R1P5	122	91	YES
126	013960641	HNBA	VHW1	13	12	YES
126	013920601	HNBA	VED2	53	23	YES 11/21/96
126	011520865	HNBA	QHH2	70	52	YES 11/21/96
126	012679908	HNBA	SSN1	68	62	YES 11/21/96
127	010882352	ASMA	N542	119	110	YES
127	010345226	ASMA	LJ89	7	5	YES
128	005432534	MS7A	B7B1	171	147	YES
128	001488307	MS7A	KWQ0	2	2	YES
128	012300197	MS7A	RWP9	236	211	YES
129	001590841	JX85	JX85	31	25	NO
130	001462189	HW94	HW94	22	10	NO
131	009186727	MA9A	EJ17	37	33	YES
131	010978747	MA9A	PDW5	72	63	YES
132	004428061	E1RA	LYE6	6	3	YES 11/21/96
132	010802827	E1RA	N0H4	87	46	YES 11/21/96
133	012714485	E3MA	SF18	74	72	YES
133	011460316	E3MA	P622	8	7	YES
133	011258875	E3MA	PWV5	2	2	NO
133	011755608	E3MA	QVR1	15	14	YES
134	007196882	LN2A	C2Q8	360	351	YES
135	010113449	5RPA	K663	135	128	YES 11/21/96
135	010152470	5RPA	K934	14	11	YES 11/21/96
136	011435655	PWA3	PWA3	193	171	YES 11/21/96
137	013024449	R6N9	R6N9	151	98	YES
138	002453019	A5PA	JAJ7	3	3	NO
138	010313860	A5PA	LWR9	21	19	NO
139	005316389	K34A	B531	75	59	YES
139	006638694	K34A	CR33	38	17	YES
140	010228659	42LA	K952	123	113	YES 11/21/96
140	010045857	42LA	K6H6	56	48	YES 11/21/96
141	013294431	THT4	THT4	110	76	YES
142	001167532	A607	A607	65	60	YES
143	010488044	LXT1	LXT1	33	22	YES 11/21/96
144	000198390	C6PA	ADA0	76	65	YES
144	009069917	C6PA	EC45	143	128	YES
145	012567287	R6D0	R6D0	151	118	YES
146	013436950	PE4A	T2W2	14	7	NO
146	012917094	PE4A	STC8	4	4	NO
147	005872517	6DBA	K451	5	5	NO
147	011325908	6DBA	P485	114	91	YES 11/21/96
148	001531338	HTW0	HTW0	288	190	YES 11/21/96
149	010130942	LAW6	LAW6	72	31	YES 11/21/96
150	001690556	AUWA	HEJ1	2	2	YES 11/21/96
150	001263350	AUWA	K414	5	4	YES 11/21/96

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
150	013617332	AUWA	UCH2	14	14	YES 11/21/96
151	010049816	6A8A	K3X7	12	7	NO
151	002764157	6A8A	KKL0	3	1	NO
152	010333754	B1FA	L1A6	45	35	YES
153	004858099	HR3A	6NH5	86	52	YES
153	011729446	HR3A	QS87	18	14	YES
154	012571966	H3XA	SB08	30	12	NO
155	012727994	JWVA	SHP9	3	3	NO
155	011544780	JWVA	QCJ9	42	33	YES 11/21/96
156	005854132	FSQA	CCC3	5	4	NO
156	006207888	FSQA	CKA6	2	1	NO
156	005278356	FSQA	B5P6	1	0	NO
156	008116070	FSQA	DMW6	26	20	NO
156	010045856	FSQA	QLY9	61	35	NO
157	009699480	E239	E239	101	75	YES 11/21/96
158	010481284	5YQA	LXY8	160	143	YES
159	010295759	LKB8	LKB8	26	6	YES
160	004022524	QANA	GME2	5	5	YES 11/21/96
160	012314819	QANA	RVW1	82	25	YES 11/21/96
161	011310640	P6U5	P6U5	36	30	NO
162	009998059	G4VA	FA14	2	1	YES 11/21/96
162	001068508	G4VA	JYK1	46	39	YES 11/21/96
162	006888478	G4VA	CV55	4	2	YES 11/21/96
162	013848736	G4VA	VAS5	1	1	YES
163	011872334	BTUB	Q6K1	5	3	NO
163	001138219	BTUB	KY14	10	4	NO
164	009023520	BTJA	EBG8	18	7	YES 11/21/96
164	001249917	BTJA	KYB3	149	82	YES 11/21/96
165	011677491	E1PA	QH45	101	88	YES 11/21/96
166	000216755	AEG6	AEG6	215	189	YES 11/21/96
167	012016153	NWYA	Q979	52	38	YES
168	001101119	TP2A	JYL1	39	17	NO
168	001684341	TP2A	G7F0	3	2	NO
169	011594773	P9T5	P9T5	78	39	YES
170	001341530	VH5A	KP59	66	49	NO
171	001692250	01JA	J3L0	31	26	NO
172	001340130	BAR7	BAR7	113	77	YES 11/21/96
173	010492501	CTCA	LXY9	52	43	YES
174	010393707	LHK3	LHK3	96	58	YES
175	001515363	EEQA	HFF7	43	42	NO
175	009280216	EEQA	EM72	15	14	YES 11/21/96
175	012427236	EEQA	R0F3	14	13	NO
175	010639054	EEQA	L8Y0	107	102	YES 11/21/96
176	010912877	N422	N422	57	19	NO
177	011489826	PPH4	PPH4	73	36	YES 11/21/96
178	001288178	K1TA	K5G4	65	41	YES
179	013360460	PB2B	TET2	136	126	YES

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
179	011790553	PB2B	Q2W3	76	69	YES 11/21/96
180	013280444	5VEA	TEY5	1	1	NO
180	010378700	5VEA	L1B5	58	57	YES
180	010302821	5VEA	L6N1	1	1	NO
181	011237973	BYFA	PU99	175	153	YES 11/21/96
182	009181982	MHBA	EJM5	116	84	YES 11/21/96
183	011395544	PWE1	PWE1	134	23	
184	011522310	G16A	QCC8	114	113	YES 11/21/96
185	004358932	KUR8	KUR8	152	133	YES
186	002453021	A5KA	JAJ8	2	2	NO
186	010313859	A5KA	LWR8	15	14	NO
187	009157868	LXTA	EHT0	19	17	YES
187	008032346	LXTA	DLL0	52	43	YES
187	012660999	LXTA	SA41	41	40	YES
188	010091406	LAD2	LAD2	78	58	NO
189	009156878	EHJ0	EHJ0	45	44	YES 11/21/96
190	011987705	RC36	RC36	167	131	YES 11/21/96
191	005051671	MTP4	MTP4	55	41	YES
192	007557169	C800	C800	191	121	YES 11/21/96
193	002527914	J9V3	J9V3	53	35	YES
194	012225163	RMA0	RMA0	43	38	NO
195	009192188	LQAA	EKG0	3	3	NO
195	010478368	LQAA	LX67	40	30	YES
195	002347118	LQAA	QXL8	15	11	NO
195	011763649	LQAA	QW57	123	95	YES
196	013574406	FT8B	UAH6	20	19	YES
196	010936979	FT8B	PGA1	46	39	YES
197	004056461	C8RA	HR67	86	74	YES 11/21/96
197	001680797	C8RA	BCN0	1	1	YES 11/21/96
198	010796685	NU44	NU44	71	59	YES
199	001462190	JNU6	JNU6	13	6	NO
200	009965281	HHYA	E9U1	23	16	YES
200	011560788	HHYA	QJM5	26	23	YES
201	008911592	AFLA	D850	36	13	YES 11/21/96
201	009349088	AFLA	EP32	20	8	NO
201	000141773	AFLA	ABM7	3	0	NO
202	007575816	ARWA	HNU1	1	1	YES 11/21/96
202	010827188	ARWA	NX22	95	94	YES 11/21/96
203	011614443	HHXA	QJC8	185	163	YES
204	000049766	JQD5	JQD5	71	55	NO
205	011567310	QB77	QB77	57	26	YES 11/21/96
206	013759999	M45A	U8L9	56	41	YES
206	013143593	M45A	S4H6	19	19	YES
206	011049349	M45A	PE26	19	2	NO
207	009639444	J3HA	E1J8	259	229	YES
207	011407620	J3HA	P481	641	621	YES
208	010221862	5KPA	LB72	26	12	YES

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
208	011585975	5KPA	QK46	61	46	YES
208	010166532	5KPA	LB73	23	9	YES
209	001047326	A127	A127	48	13	NO
210	001823133	G665	G665	123	76	YES 11/21/96
211	002833914	KKH7	KKH7	11	6	YES
212	011136033	PK86	PK86	106	65	YES 11/21/96
213	010045654	K536	K536	28	25	YES 11/21/96
214	011100735	32PA	PM50	173	159	YES 11/21/96
215	011788617	Q2P6	Q2P6	50	38	YES 11/21/96
216	004860546	HKLA	H9D9	236	144	YES
217	007195228	C2A8	C2A8	93	88	YES
218	010228570	4M1A	K659	75	62	YES 11/21/96
218	010258739	4M1A	K932	16	14	YES 11/21/96
219	003897956	CNKA	KRR5	15	15	NO
219	010520189	CNKA	L212	27	25	YES 11/21/96
220	012204519	PHGB	RQX1	8	5	NO
220	012231619	PHGB	RLF7	28	19	NO
221	009123104	EGT2	EGT2	95	65	YES 11/21/96
222	010864200	GF8A	P562	34	21	NO
223		G4GA	VRF2	17	12	NO
223	011529779	G4GA	QG49	4	2	YES 11/21/96
223	011529778	G4GA	QG48	3	3	YES 11/21/96
223	011692574	G4GA	QX28	15	13	YES 11/21/96
223	011742122	G4GA	QVM8	12	8	YES 11/21/96
223	011822077	G4GA	Q5B5	94	81	YES 11/21/96
224	001376532	AF7A	KX99	47	32	YES
225	011625010	HBHA	QG66	1	0	NO
225	011512890	HBHA	QHD3	29	18	NO
227	011257196	P1Y0	P1Y0	211	113	YES 11/21/96
228	012502685	ABEA	R2R6	60	44	NO
229	009309082	EGTA	ENU9	1	0	NO
229	004102842	EGTA	FS37	1	0	NO
229	001690637	EGTA	HE46	54	16	YES 11/21/96
230	009331802	EPH2	EPH2	141	97	YES 11/21/96
231	012225158	RL93	RL93	83	69	YES
232	011630293	A4XA	QNA1	62	60	YES
233	003462708	KNK1	KNK1	8	5	YES 11/21/96
234	013620228	GSPA	UCL2	19	10	YES
234	011452538	GSPA	PWB7	20	14	YES
235	013351399	DWWA	TFV5	13	9	YES 11/21/96
235	011544774	DWWA	QHC9	61	38	YES 11/21/96
235	011271946	DWWA	PSN7	1	0	YES 11/21/96
236	011076966	MFLA	PK82	25	8	YES
236	012653660	MFLA	R8W9	47	20	YES
237	007176091	LM5A	C1J9	48	45	YES
237	005049031	LM5A	B1Q8	17	0	YES
237	007944748	LM5A	DHH7	37	32	YES

NADEP North Island
80% Revenue Generators

Pri	NIIN	FIC	IIC	IND	RFI	Locked
238	012917093	STC7	STC7	12	7	YES
239	000666325	AP68	AP68	23	23	NO
240	012225182	RL99	RL99	65	57	YES
241	009060598	XVRA	EB65	97	63	YES
241	009190662	XVRA	EKD9	3	3	YES
242	012343358	BS5A	RUU3	15	8	YES
242	013448678	BS5A	T0L3	16	7	YES
243	004675763	KXT0	KXT0	24	12	YES 11/21/96
244	004795033	32XA	JAS8	1	1	NO
244	001389683	32XA	K0U5	20	10	NO
245	000109714	AAT7	AAT7	77	66	YES 11/21/96
246	013130126	BHLA	STC2	13	7	NO
246	012567405	BHLA	R3L2	12	8	NO
247	012132135	AUCA	RKV1	41	37	NO
248	001525091	HTV0	HTV0	182	138	YES 11/21/96
249	011987679	J06A	RC28	26	16	YES 11/21/96
249	011424304	J06A	PWD5	101	88	YES 11/21/96
250	001159290	A6D3	A6D3	115	107	YES
251	011545817	GX4A	QH81	7	7	NO
251	011489833	GX4A	QB38	4	0	NO
251	012429763	GX4A	RX23	51	42	NO
252	011915694	Q4V7	Q4V7	6	5	YES 11/21/96
253	003952548	AG3A	KTU4	10	7	YES
253	010877738	AG3A	NXT6	196	179	NO
254	007614903	2STB	JAX3	13	1	NO
256	001686031	PEJA	GYQ5	67	57	YES 11/21/96
257	001101746	TPXA	JYM2	25	23	NO
257	010979234	TPXA	PBV4	31	28	NO
258	013620246	UCL7	UCL7	30	16	NO
259	010049814	6FNA	K402	1	1	NO
259	003581630	6FNA	KUK4	1	1	NO
259	010749783	6FNA	NWH7	7	2	YES 11/21/96
259	010533444	6FNA	L2X2	37	9	NO
260	013177764	APBA	SY82	10	7	NO
260	011252995	APBA	P1S7	13	10	NO

APPENDIX C. NADEP NI QUARTERLY COMPONENT PRODUCTION REPORTS

.DATE 11:37:57 RID 529G 29 MAY 98 FANCY

.THESIS S REPORT

*WEEK (8081 THRU 8087) QUARTER (7362 THRU 8087)

*			PROD	ICP	NEG		CARRY	.... R	E T U	R N S	....					MDR	AVG	.......MSIR	QUANTITIES	....			
*FIC	PREL	RSHOP	REQ	REQ	WLSTD		IN	IND	IP	RFI	F/0	F/7	MIS	G	SUR	TAT	TAT	A	G	D	E	F	M
280A	13	93501	0	0	55.85	WK		3	8	0	0	0	0	0	0	28	0	30	6	0	0	124	14
280A	13	93501	0	0	55.85	QTR	6	6	8	0	0	0	0	3	1								
5QQA	23	93305	5	9	165.40	WK		0	12	0	0	0	0	0	0	39	48	0	7	0	0	8	12
5QQA	23	93305	5	9	165.40	QTR	13	5	12	5	0	0	0	0	1								
A4XA	23	93806	15	15	20.58	WK		2	8	0	0	0	0	0	0	25	24	22	2	0	0	14	9
A4XA	23	93806	15	15	20.58	QTR	5	19	8	15	0	0	0	1	0								
A607	2	93504	2	2	29.04	WK		0	0	0	0	0	0	0	0	20	28	12	1	0	0	32	0
A607	2	93504	2	2	29.04	QTR	0	2	0	2	0	0	0	0	0								
AEG6	56	93302	13	13	14.17	WK		0	17	0	0	0	0	0	0	21	26	45	12	0	0	14	30
AEG6	56	93302	13	13	14.17	QTR	6	27	17	13	0	3	0	0	0								
ARWA	19	93607	33	33	16.51	WK		3	11	2	0	0	0	0	0	22	26	49	0	0	0	70	11
ARWA	19	93607	33	33	16.51	QTR	6	38	11	33	0	0	0	0	0								
B1FA	0	93502	1	1	67.16	WK		0	0	0	0	0	0	0	0	26	2	28	0	0	0	24	0
B1FA	0	93502	1	1	67.16	QTR	0	1	0	1	0	0	0	0	0								
BAR7	7	93807	9	9	16.60	WK		0	0	1	0	0	0	0	0	25	34	51	0	0	0	2	1
BAR7	7	93807	9	9	16.60	QTR	0	9	0	9	0	0	0	0	0								
BS5A	1550	93503	3	3	40.13	WK		1	1	0	0	0	0	0	1	26	20	4	3	0	0	4	7
BS5A	1550	93503	3	3	40.13	QTR	3	10	1	2	7	1	0	0	2								
C6PA	4	93808	6	6	10.50	WK		0	1	3	0	0	0	0	0	24	36	48	0	0	0	73	2
C6PA	4	93808	6	6	10.50	QTR	6	5	1	6	0	0	0	0	4								
C800	0	93301	30	54	9.59	WK		0	0	0	0	0	0	0	0	22	20	9	0	0	0	18	0
C800	0	93301	30	54	9.59	QTR	0	54	0	31	0	1	0	0	22								
E1RA	12	93303	27	27	24.47	WK		0	17	0	0	0	0	6	0	39	34	26	28	0	0	2	21
E1RA	12	93303	27	27	24.47	QTR	12	47	17	27	0	0	0	15	0								

FQAA	3	93208	13	18	79.83	WK		0	12	0	0	0	0	0	0	64	36	0	15	1	0	15	11
FQAA	3	93208	13	18	79.83	QTR	6	22	12	15	0	1	0	0	0								
FRSA	10	93301	34	34	77.43	WK		0	28	11	0	1	0	4	0	49	44	28	42	0	0	29	49
FRSA	10	93301	34	34	77.43	QTR	56	48	28	38	0	2	0	33	3								
G4VA	24	93303	18	67	24.72	WK		0	14	0	0	0	0	0	0	65	66	5	39	0	0	6	24
G4VA	24	93303	18	67	24.72	QTR	19	22	14	18	0	0	0	9	0								
GRUA	8	93209	8	11	114.68	WK		0	7	1	0	0	0	0	1	107	219	19	0	0	0	27	8
GRUA	8	93209	8	11	114.68	QTR	9	2	7	2	0	0	0	0	2								
HBPA	8	93807	31	149	23.41	WK		2	30	0	0	0	0	0	0	28	30	0	41	0	0	95	30
HBPA	8	93807	31	149	23.41	QTR	40	52	30	30	0	2	0	28	2								
JAJ9	1	93207	8	8	152.05	WK		0	11	0	0	0	0	0	0	97	97	31	0	0	0	44	11
JAJ9	1	93207	8	8	152.05	QTR	14	6	11	8	0	0	0	0	1								
KF86	31	93607	35	35	27.34	WK		14	25	5	0	0	0	0	0	30	33	6	7	0	0	208	38
KF86	31	93607	35	35	27.34	QTR	14	57	25	35	0	1	0	10	0								
MHBA	20	93303	11	11	15.79	WK		2	8	1	0	0	0	0	0	41	63	48	4	0	0	4	12
MHBA	20	93303	11	11	15.79	QTR	10	13	8	11	0	0	0	3	1								
P1Y0	14	93302	60	107	6.29	WK		0	26	15	0	0	0	0	0	25	30	0	31	0	0	2	38
P1Y0	14	93302	60	107	6.29	QTR	16	80	26	60	0	5	0	0	5								
PK86	9	93303	7	10	13.47	WK		0	1	0	0	0	0	0	0	39	39	37	14	0	0	5	2
PK86	9	93303	7	10	13.47	QTR	4	6	1	7	0	0	0	2	0								
PWC4	116	93303	77	77	19.91	WK		8	36	6	0	0	0	22	0	35	29	1	38	0	0	12	39
PWC4	116	93303	77	77	19.91	QTR	21	117	36	61	0	1	0	34	6								
PXBA	37	93305	26	26	15.65	WK		0	14	2	0	0	0	0	0	51	87	0	0	0	0	19	22
PXBA	37	93305	26	26	15.65	QTR	37	42	14	26	0	0	0	0	39								
Q2H4	10	93302	20	30	29.25	WK		0	2	0	0	0	0	0	0	46	30	10	8	0	0	2	1
Q2H4	10	93302	20	30	29.25	QTR	5	11	2	13	0	0	0	1	0								
Q4V7	2	93305	5	8	160.93	WK		0	14	0	0	0	0	0	0	80	0	0	2	0	0	2	14
Q4V7	2	93305	5	8	160.93	QTR	14	2	14	0	1	0	0	0	1								

..... END REPORT .....

.DATE 29 MAY 98 10:45:32 RID 522G 29 MAY 98 FANCY

.THESIS S REPORT

*WEEK (7355 THRU 7361) QUARTER (7271 THRU 7361)

*1ST QTR 98			PROD	ICP	NEG		CARRY	....	R E T U	R N S	....				MDR	AVG	....	MSIR	QUANTITIES	....		
*FIC	SN	RSHOP	REQ	REQ	WLSTD		IN	IND	IP	RFI	F/0	F/7	MIS	G	SUR	TAT	TAT	A	G	D	E	F	M
280A	3204	93501	14	14	67.35	WK		0	9	0	0	0	0	0	0	28	27	12	1	0	0	22	14
280A	3204	93501	14	14	67.35	QTR	7	16	9	12	2	0	0	0	0								
5QQA	3800	93305	10	24	165.40	WK		0	13	0	0	0	0	0	0	39	15	0	12	0	0	9	13
5QQA	3800	93305	10	24	165.40	QTR	5	14	13	1	0	0	0	5	0								
A4XA	1460	93806	11	23	20.89	WK		0	5	0	0	0	0	0	0	25	27	15	1	0	0	11	8
A4XA	1460	93806	11	23	20.89	QTR	3	13	5	11	0	0	0	0	0								
A607	3102	93504	2	2	35.50	WK		0	0	0	1	0	0	0	0	20	42	25	1	0	0	21	3
A607	3102	93504	2	2	35.50	QTR	2	4	0	2	3	0	0	1	0								
AEG6	5137	93302	56	56	4.58	WK		0	6	0	0	0	0	0	0	22	29	62	30	0	0	6	1
AEG6	5137	93302	56	56	4.58	QTR	38	17	6	35	0	0	0	12	2								
ARWA	3018	93607	20	20	14.60	WK		0	6	0	0	0	0	0	0	22	25	28	0	0	0	92	9
ARWA	3018	93607	20	20	14.60	QTR	6	23	6	20	0	1	0	0	2								
B1FA	2472	93502	0	0	47.12	WK		0	1	0	0	0	0	0	0	25	24	86	0	0	0	65	3
B1FA	2472	93502	0	0	47.12	QTR	3	2	1	4	0	0	0	0	0								
BAR7	3605	93807	7	7	16.60	WK		0	0	0	0	0	0	0	0	20	38	53	1	0	0	17	0
BAR7	3605	93807	7	7	16.60	QTR	5	2	0	7	0	0	0	0	0								
BS5A	1550	93503	5	5	18.14	WK		0	4	0	0	0	0	0	0	26	33	5	8	0	0	1	11
BS5A	1550	93503	5	5	18.14	QTR	6	2	4	3	0	0	1	0	0								
C6PA	3104	93808	2	0	10.50	WK		0	6	0	0	0	0	0	0	24	28	76	1	0	0	34	4
C6PA	3104	93808	2	0	10.50	QTR	15	15	6	12	10	1	0	0	1								
C800	5208	93301	35	0	8.41	WK		0	0	0	0	0	0	0	0	22	11	9	0	0	0	40	2
C800	5208	93301	35	0	8.41	QTR	0	59	0	38	1	0	0	0	20								
E1RA	2454	93303	35	58	18.67	WK		0	15	0	0	0	0	0	0	37	50	6	41	0	0	7	23
E1RA	2454	93303	35	58	18.67	QTR	23	21	15	16	0	1	0	12	0								

FQAA	1464	93208	7	10	79.83	WK		0	6	3	0	0	0	0	1	64	81	2	38	1	0	10	29
FQAA	1464	93208	7	10	79.83	QTR	14	13	6	15	0	1	0	4	1								
FRSA	3860	93301	16	23	66.27	WK		24	56	0	0	0	0	0	0	49	40	2	60	0	0	31	46
FRSA	3860	93301	16	23	66.27	QTR	30	74	56	33	0	1	0	14	0								
G4VA	2410	93303	28	83	37.77	WK		0	21	0	0	0	0	0	0	66	56	1	29	0	0	6	36
G4VA	2410	93303	28	83	37.77	QTR	19	25	21	17	0	2	0	4	0								
GRUA	1462	93209	13	18	160.60	WK		0	11	0	7	0	0	0	0	112	256	0	0	0	0	10	19
GRUA	1462	93209	13	18	160.60	QTR	14	7	11	3	7	0	0	0	0								
HBPA	1412	93807	8	8	23.41	WK		0	42	0	0	0	0	0	0	28	44	6	16	0	0	34	37
HBPA	1412	93807	8	8	23.41	QTR	39	55	42	34	16	0	0	1	1								
JAJ9	2848	93207	4	1	104.87	WK		0	14	0	0	0	0	0	0	96	56	19	6	0	0	36	17
JAJ9	2848	93207	4	1	104.87	QTR	5	18	14	9	0	0	0	0	0								
KF86	3728	93607	51	71	29.20	WK		0	14	4	0	0	0	3	0	30	35	0	29	0	0	195	34
KF86	3728	93607	51	71	29.20	QTR	21	60	14	40	0	2	0	21	4								
MHBA	2403	93303	20	20	19.65	WK		0	11	0	0	0	0	0	0	41	28	38	3	0	0	3	22
MHBA	2403	93303	20	20	19.65	QTR	8	27	11	20	0	1	0	2	1								
P1Y0	1541	93302	0	84	6.22	WK		0	17	0	0	0	0	0	0	25	184	0	80	0	0	40	1
P1Y0	1541	93302	0	84	6.22	QTR	9	16	17	6	0	0	0	1	1								
PK86	1639	93303	16	13	13.47	WK		0	4	1	0	0	0	0	0	38	43	27	13	0	0	1	10
PK86	1639	93303	16	13	13.47	QTR	5	13	4	14	0	0	0	0	0								
PWC4	1420	93303	80	116	14.48	WK		0	25	1	0	0	0	0	0	37	51	0	8	0	0	57	36
PWC4	1420	93303	80	116	14.48	QTR	35	43	25	30	0	2	0	20	1								
PXBA	2438	93305	38	38	12.25	WK		0	37	0	0	0	0	0	0	51	84	4	0	0	0	16	56
PXBA	2438	93305	38	38	12.25	QTR	42	52	37	25	0	0	0	0	32								
Q2H4	1424	93302	14	10	19.48	WK		0	5	2	0	0	0	0	0	46	30	2	7	0	0	0	11
Q2H4	1424	93302	14	10	19.48	QTR	6	16	5	14	2	0	0	1	0								
Q4V7	2992	93305	10	17	201.26	WK		0	14	0	0	0	0	0	0	84	0	0	3	0	0	11	14
Q4V7	2992	93305	10	17	201.26	QTR	8	6	14	0	0	0	0	0	0								

..... END REPORT .....

APPENDIX D. FORECAST DATA ANALYSIS TABLES

FIC	Qtr 1 ICP Prelim	Qtr 1 RFI Comp	Absolute Difference	Pct Variation
280A	15	12	3	20%
5QQA	9	1	8	89%
A4XA	13	11	2	15%
A607	11	2	9	82%
AEG6	48	35	13	27%
ARWA	21	20	1	5%
B1FA	5	4	1	20%
BAR7	7	7	0	0%
BS5A	10	3	7	70%
C6PA	20	12	8	40%
C800	30	38	8	27%
E1RA	14	16	2	14%
FQAA	16	15	1	6%
FRSA	8	33	25	313%
G4VA	16	17	1	6%
GRUA	1	3	2	200%
HBPA	50	34	16	32%
JAJ9	4	9	5	125%
KF86	23	40	17	74%
MHBA	12	20	8	67%
P1Y0	15	6	9	60%
PK86	11	14	3	27%
PWC4	83	30	53	64%
PXBA	40	25	15	38%
Q2H4	7	14	7	100%
Q4V7	2	0	2	100%

Mean	18.88	16.19	8.69	62%
Median	13.50	14.00	7.00	39%
Range	82.00	40	53	313%

FIC	Qtr 1 ICP Revised	Qtr 1 RFI Comp	Absolute Difference	Pct Variation
280A	14	12	2	14%
5QQA	24	1	23	96%
A4XA	23	11	12	52%
A607	2	2	0	0%
AEG6	56	35	21	38%
ARWA	20	20	0	0%
B1FA	0	4	4	Undefined
BAR7	7	7	0	0%
BS5A	5	3	2	40%
C6PA	0	12	12	Undefined
C800	0	38	38	Undefined
E1RA	58	16	42	72%
FQAA	10	15	5	50%
FRSA	23	33	10	43%
G4VA	83	17	66	80%
GRUA	18	3	15	83%
HBPA	8	34	26	325%
JAJ9	1	9	8	800%
KF86	71	40	31	44%
MHBA	20	20	0	0%
P1Y0	84	6	78	93%
PK86	13	14	1	8%
PWC4	116	30	86	74%
PXBA	38	25	13	34%
Q2H4	10	14	4	40%
Q4V7	17	0	17	100%

Mean	27.73	16.19	19.85	91%
Median	17.50	14.00	12.00	44%
Range	116.00	40	86	800%

FIC	Qtr 1 CRC Negtd	Qtr 1 RFI Comp	Absolute Difference	Pct Variation
280A	14	12	2	14%
5QQA	10	1	9	90%
A4XA	11	11	0	0%
A607	2	2	0	0%
AEG6	56	35	21	38%
ARWA	20	20	0	0%
B1FA	0	4	4	Undefined
BAR7	7	7	0	0%
BS5A	5	3	2	40%
C6PA	2	12	10	500%
C800	35	38	3	9%
E1RA	35	16	19	54%
FQAA	7	15	8	114%
FRSA	16	33	17	106%
G4VA	28	17	11	39%
GRUA	13	3	10	77%
HBPA	8	34	26	325%
JAJ9	4	9	5	125%
KF86	51	40	11	22%
MHBA	20	20	0	0%
P1Y0	0	6	6	Undefined
PK86	16	14	2	13%
PWC4	80	30	50	63%
PXBA	38	25	13	34%
Q2H4	14	14	0	0%
Q4V7	10	0	10	100%

Mean	19.31	16.19	9.19	73%
Median	13.50	14.00	7.00	38%
Range	80.00	40	50	500%

FIC	Qtr 2 ICP Prelim	Qtr 2 RFI Comp	Absolute Difference	Pct Variation
280A	13	0	13	100%
5QQA	23	5	18	78%
A4XA	23	15	8	35%
A607	2	2	0	0%
AEG6	56	13	43	77%
ARWA	19	33	14	74%
B1FA	0	1	1	Undefined
BAR7	7	9	2	29%
BS5A	15	2	13	87%
C6PA	4	6	2	50%
C800	0	31	31	Undefined
E1RA	12	27	15	125%
FQAA	3	15	12	400%
FRSA	10	38	28	280%
G4VA	24	18	6	25%
GRUA	8	2	6	75%
HBPA	8	30	22	275%
JAJ9	1	8	7	700%
KF86	31	35	4	13%
MHBA	20	11	9	45%
P1Y0	14	60	46	329%
PK86	9	7	2	22%
PWC4	116	61	55	47%
PXBA	37	26	11	30%
Q2H4	10	13	3	30%
Q4V7	2	0	2	100%

Mean	17.96	18.00	14.35	126%
Median	11.00	13.00	10.00	74%
Range	116.00	61	55	700%

FIC	Qtr 2 ICP Revised	Qtr 2 RFI Comp	Absolute Difference	Pct Variation
280A	0	0	0	Undefined
5QQA	9	5	4	44%
A4XA	15	15	0	0%
A607	2	2	0	0%
AEG6	13	13	0	0%
ARWA	33	33	0	0%
B1FA	1	1	0	0%
BAR7	9	9	0	0%
BS5A	3	2	1	33%
C6PA	6	6	0	0%
C800	54	31	23	43%
E1RA	27	27	0	0%
FQAA	18	15	3	17%
FRSA	34	38	4	12%
G4VA	67	18	49	73%
GRUA	11	2	9	82%
HBPA	149	30	119	80%
JAJ9	8	8	0	0%
KF86	35	35	0	0%
MHBA	11	11	0	0%
P1Y0	107	60	47	44%
PK86	10	7	3	30%
PWC4	77	61	16	21%
PXBA	26	26	0	0%
Q2H4	30	13	17	57%
Q4V7	8	0	8	100%

Mean	29.35	18.00	11.65	25%
Median	14.00	13.00	0.50	12%
Range	149.00	61	119	800%

FIC	Qtr 2 CRC Negtd	Qtr 2 RFI Comp	Absolute Difference	Pct Variation
280A	0	0	0	Undefined
5QQA	5	5	0	0%
A4XA	15	15	0	0%
A607	2	2	0	0%
AEG6	13	13	0	0%
ARWA	33	33	0	0%
B1FA	1	1	0	0%
BAR7	9	9	0	0%
BS5A	3	2	1	33%
C6PA	6	6	0	0%
C800	30	31	1	3%
E1RA	27	27	0	0%
FQAA	13	15	2	15%
FRSA	34	38	4	12%
G4VA	18	18	0	0%
GRUA	8	2	6	75%
HBPA	31	30	1	3%
JAJ9	8	8	0	0%
KF86	35	35	0	0%
MHBA	11	11	0	0%
P1Y0	60	60	0	0%
PK86	7	7	0	0%
PWC4	77	61	16	21%
PXBA	26	26	0	0%
Q2H4	20	13	7	35%
Q4V7	5	0	5	100%

Mean	19.12	18.00	1.65	12%
Median	13.00	13.00	0.00	0%
Range	77.00	61	4	100%

APPENDIX E. BOM DEPTH ANALYSIS TABLE

Component Inductions	BOM Depth Accuracy	Weighted BOM Acc
42	0.792	0.010
61	0.726	0.013
62	0.989	0.019
65	0.995	0.020
215	0.976	0.063
95	0.973	0.028
45	0.873	0.012
113	0.951	0.032
31	0.763	0.007
219	0.998	0.066
191	1.000	0.058
87	0.892	0.023
81	0.825	0.020
216	0.950	0.062
52	0.748	0.012
21	0.759	0.005
390	0.894	0.105
48	0.945	0.014
135	0.972	0.040
116	0.937	0.033
211	0.811	0.052
106	0.984	0.031
274	0.966	0.080
317	1.000	0.096
112	0.987	0.033
6	0.000	0.000
3311	Totals	0.934

APPENDIX F. G CONDITION STATUS REPORT

COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	E	6115	011625000	GF	HBPA		93807	L	NWRN32731774950001	98028	98042	AWP	0		U238308
7R	E	6115	011625000	GF	HBPA		93807	L	NWRN32732300350001	98028	98042	AWP	0		U254130
7R	H	6115	013036743	GF	HBPA		93807	L	NWRN32729655240001	98028	98042	AWP	0		U243597
7R	E	6115	011625000	GF	HBPA		93807	L	NWRN32732077300001	98028	98042	AWP	0		U242113
7R	E	6115	011625000	GF	HBPA		93807	L	NWRN32731774940001	98028	98042	AWP	0		U238301
7R	E	6115	011625000	GF	HBPA		93807	L	NWRN32714768460005	97289	97301	AWP	0		T792451
7R	E	6115	011625000	GF	HBPA		93807	S	NWRN32718012370001	97231	97287	AWP	0		T864738
7R	E	6115	011625000	GF	HBPA		93807	B	NWRN32714768460003	97231	97345	AWP	0		T792439
7R	E	6115	011625000	GF	HBPA		93807	L	NWRN32714768460004	97255	97287	AWP	0		T792445
7R	E	6115	011542567	GF	HBPA		93807	L	NWRN32714266210001	97255	97279	AWP	0		T784216
7R	E	6115	011625000	GF	HBPA		93807	L	NWRN32735186700001	98093	98099	AWP	0		U317753
7R	E	6115	011625000	GF	HBPA		93807	L	NWRN32800724390001	98093	98103	AWP	0		U341919

TOTAL AWC FOR HBPA: 0 TOTAL AWI FOR HBPA: 1 TOTAL AWP FOR HBPA: 41 TOTAL COMPONENTS FOR HBPA: 42

COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	H	6115	011726527	GF	HBQB		93807	L	NWSN32506238990003	98016	98071	AWP	0		U000637
7R	H	6115	011726527	GF	HBQB		93807	L	NWRN32718817500001	97245	97279	AWP	0		T871450
7R	H	6115	011726527	GF	HBQB		93807	L	NWRN32719425290001	97245	97279	AWP	0		T887434

TOTAL AWC FOR HBQB: 0 TOTAL AWI FOR HBQB: 0 TOTAL AWP FOR HBQB: 3 TOTAL COMPONENTS FOR HBQB: 3

COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	H	5895	011547584	GF	HCSA		93503	L	NWSN32623632940005	97062	97107	AWP	0		T450632

TOTAL AWC FOR HCSA: 0 TOTAL AWI FOR HCSA: 0 TOTAL AWP FOR HCSA: 1 TOTAL COMPONENTS FOR HCSA: 1

COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	E	2840	011520853	GF	HCHA	71F7	93105	L	NWRN32627562550002	97028	97042	AWP	0		T313189
7R	E	2840	011520853	GF	HCHA	71F7	93105	L	NWRN32627562650001	97028	97042	AWP	0		T313152
7R	E	2840	011520853	GF	HCHA	71F7	93105	L	NWRN32628266530001	96323	97086	AWP	0		T326535
7R	E	2840	011520854	GF	HCHA		93105	L	NWRN32520607190002	95289	95292	AWP	0		R637951
7R	E	2840	011520853	GF	HCHA	71F7	93105	L	NWRN32627562650003	97154	97188	AWP	0		T313226
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32619831690002	96269	96277	AWP	0		T208399
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32617019820004	96268	96277	AWP	0		T167754
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32619128470001	96269	96277	AWP	0		T209264
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32621940660002	96278	96320	AWP	0		T215226
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32523344600001	96269	96277	AWP	0		T236742
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32617019820002	96268	96277	AWP	0		T139319
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32621940660001	96274	96305	AWP	0		T215189
7R	E	2840	011520853	GF	HCHA	71F7	93105	L	NWRN32617019820003	97332	97335	AWP	0		T139325
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32619128470002	96268	96277	AWP	0		T179396
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32625452710001	96274	96305	AWP	0		T275130
7R	E	2840	011520854	GF	HCHA		93105	L	NWRN32609289610004	97224	97234	AWP	0		T729744
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32619831690003	96269	96277	AWP	0		T212587
7R	E	2840	011520853	GF	HCHA	71F7	93105	B	NWRN32618224660001	96269	96277	AWP	0		T167976
7R	E	2840	011520853	GF	HCHA	71F7	93105	L	NWRN32617019820005	97332	97335	AWP	0		T139337

TOTAL AWC FOR HCHA: 0 TOTAL AWI FOR HCHA: 0 TOTAL AWP FOR HCHA: 19 TOTAL COMPONENTS FOR HCHA: 19

COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	H	5821	012836742	FP	HDNA	SH67	93504	L	NWSN32701526250018	98023	98044	AWP	0		T841380
7R	H	5821	012836742	FP	HDNA	SH67	93504	L	NWSN32701526250016	97224	97248	AWP	0		T824159

TOTAL AWC FOR HDNA: 0 TOTAL AWI FOR HDNA: 0 TOTAL AWP FOR HDNA: 2 TOTAL COMPONENTS FOR HDNA: 2

COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32720436340001	97239	97274	AWP	0		T920168
7R	E	6610	011428323	DA	HE3A		93606	L	NWJN32120236340001	97239	97260	AWP	0		T913285

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COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32628165280003	96319	97125	AWP			T322923
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32704758840001	97090	97107	AWP	0		T544833
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32620433820001	96319	97125	AWP			T190620
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32433451690001	96086	96095	AWP	0		R876712
7R	E	6610	001679800	DA	HE3A		93606	L	NWRN32714768500008	97203	97213	AWP	0		T792697
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32533837830001	96080	96087	AWP	0		R849116
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32600946190004	96080	96081	AWP	0		R882435
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32501648380002	96164	96176	AWP	0		R895210
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32612202270002	96165	96176	AWP	0		T069965
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32616919270003	96206	96233	AWP	0		T135680
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32517622540001	96208	96241	AWP	0		T146809
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32605753290002	96149	96154	AWP	0		R965855
7R	E	6610	011428323	DA	HE3A		93606	L	NWRN32612202270003	96197	96233	AWP	0		T069968

TOTAL AWC FOR HE3A: 0 TOTAL AWI FOR HE3A: 0 TOTAL AWP FOR HE3A: 15 TOTAL COMPONENTS FOR HE3A: 15

COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	H	1650	004831859	FA	HEX6	HEX6	93806	L	NWSN32701323140023	97134	97157	AWP	0		T709738
7R	H	1650	004831859	FA	HEX6	HEX6	93806	L	NWSN32701323140034	97203	98072	AWP	0		T867044

TOTAL AWC FOR HEX6: 0 TOTAL AWI FOR HEX6: 0 TOTAL AWP FOR HEX6: 2 TOTAL COMPONENTS FOR HEX6: 2

COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32806762650001	98105	0	AWC	0		U514791
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN328008T3024003	98085	98098	AWP	0		U379893
7R	E	1650	013513373	GF	HF2A	T302	93302	B	NWRN32633810530001	97150	97167	AWP	0		T422142
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32706474510003	97231	97274	AWP	0		T583557
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32609289620003	97094	97098	AWP	0		T409280
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32707506630001	97209	97217	AWP	0		T621340
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32805450640001	98093		AWC			U471985
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN328008T3024012	98100	98103	AWP	0		U389524
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN328008T3024007	98103		AWC			U389499
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32804643390007	98098	98099	AWP	0		U450185
7R	E	1650	011708388	GF	HF2A		93302	L	NWRN32617019830002	97312	97312	AWP	0		T688485
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32704255180001	97276	97310	AWP	0		T542901
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32508687660001	96164	96241	AWP	0		T004977
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32805348790001	98105	0	AWC	0		U489490
7R	E	1650	011708388	GF	HF2A		93302	L	NWRN32707506600001	97238	97253	AWP	0		T821385
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32804643390001	98085	98098	AWP	0		U450155
7R	E	1650	011708388	GF	HF2A		93302	L	NWRN32517019830005	98098	98103	AWI-NS	98103		U345290
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32618325500003	97234	97274	AWP	0		T729998
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32800520440001	98051	98075	AWP	0		U332210
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32729453110001	98034	98058	AWP	0		U174788
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32801127070001	98051	98076	AWP	0		U346709
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32713862300001	98034	98056	AWP	0		U222784
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32704758860004	98034	98058	AWP	0		U253768
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32729453110002	98034	98058	AWP	0		U174793
7R	E	1650	011708388	GF	HF2A		93302	L	NWRN32706877480001	98051	98075	AWP	0		U253779
7R	E	1650	013513373	GF	HF2A	T302	93302	L	NWRN32713561310001	98006	98009	AWP	0		T760895

TOTAL AWC FOR HF2A: 4 TOTAL AWI FOR HF2A: 1 TOTAL AWP FOR HF2A: 21 TOTAL COMPONENTS FOR HF2A: 26

COG	MCC	FSC	NIIN	SM	FIC	IIC	SHOP	LS	REPAIR SCHEDULE DOCUMENT NUMBER	AWC DATE	AWP DATE	G STATUS	AWI DATE	SER NO.	LINK NO.
7R	H	5895	001887921	FP	HF44		93501	L	NWRN32718315060001	98051	98066	AWI-NP	98066		T868231
7R	H	5895	001887921	FP	HF44		93501	L	NWRN32715372770001	97224	97240	AWP	0		T813341

APPENDIX G. G CONDITION REQUISITION DATA

FIC	G Cond Assests	Reqn Julian Date	Age of Reqn (Days)
280A	1	**7281**	**219**
5QQA	6	**7232**	**268**
		7022	478
		7270	230
		7122	378
		7232	268
		7121	379
		7121	379
		6284	**582**
A4XA	1	**8119**	**16**
A607	1	**7252**	**248**
AEG6	3	**7182**	**318**
		7021	**479**
		7021	479
		7302	198
ARWA	0		
B1FA	0		
BAR7	0		
BS5A	1	**7163**	**337**
		7170	**330**
C6PA	0		
C800	0		
E1RA	20	6268	598
		6250	**616**
		6255	611
		7136	364
		7072	428
		8051	84
		7073	427
		7069	**431**
		7177	323
		7074	426
		7074	**426**
		7268	232
		7268	232

		7287	213
		7287	213
		7309	191
		7329	171
		8012	123
		8054	81
		8054	81
		8049	86
		8049	86
		8049	86
		8051	84
		8057	78
		8054	81
		8054	81
		8079	**56**
FQAA	7	**7254**	**246**
		6144	**722**
		7271	**229**
		7271	229
		7203	**297**
		7203	**297**
		7203	297
		7203	297
		8119	16
		8117	18
		8117	18
		8083	**52**
		8126	9
		8057	78
		8120	15
		8117	18
		8120	15
		8120	15
FRSA	40	7271	229
		7271	229
		7271	229
		7321	**179**
		7300	200
		7261	**239**
		7261	**239**

		7349	151
		7301	199
		7301	**199**
		7310	**190**
		7316	**184**
		7325	175
		7325	175
		7325	175
		7345	155
		7339	**161**
		7339	161
		7307	**193**
		7307	193
		7321	179
		8023	112
		7343	157
		7352	148
		7316	184
		8021	**114**
		8037	98
		8021	114
		8021	114
		8027	108
		8062	73
		8021	114
		8062	73
		8042	**93**
		8026	**109**
		8026	109
		8026	109
		8026	109
		8030	105
		8040	95
		8030	105
		8021	114
		8030	105
		8030	105
		8027	108
		8027	108
		8027	108

		8030	105
		8030	105
		8048	87
		8028	107
		8062	73
		8034	101
		8035	**100**
		8040	95
		8041	94
		8041	94
		8041	94
		8069	66
		8041	94
		8062	73
		8079	56
		8078	57
		8079	56
		8075	60
		8073	62
		8073	62
		8077	58
		8075	60
		8050	85
		8050	85
		8050	85
		8050	85
		8050	85
		8063	72
		8075	60
		8056	79
		8056	79
		8056	79
		8078	57
		8062	73
		8077	**58**
		8077	58
		8055	80
		8062	73
		8062	73
		8064	71
		8064	71

		8078	57
		8078	57
		8079	**56**
		8078	57
		8078	57
		8076	59
		8079	56
		8075	60
		8082	53
		8075	60
		8062	73
		8044	91
		8044	91
		8076	59
		8076	59
		8076	59
		8079	56
		8076	59
		8043	92
		8043	92
		8064	71
		8064	71
		8064	71
		8064	71
		8064	71
		8090	45
		8090	45
		8079	56
		8079	56
G4VA	1	**7210**	**290**
		7210	**290**
GRUA	0		
HBPA	41	8042	93
		8042	93
		8055	80
		8042	93
		8042	93
		8042	93
		8055	80
		8056	79

		8042	93
		8049	86
		8057	78
		8055	80
		8045	90
		8052	83
		8052	83
		8052	83
		8046	89
		8052	83
		8061	74
		7301	**199**
		7287	213
		7287	**213**
		7293	207
		7291	209
		8045	90
		8046	89
		8045	90
		8051	84
		7287	213
		7287	213
		7290	210
		7288	**212**
		7290	210
		7087	**413**
		7279	221
		7291	209
		7287	213
		7255	245
		8099	36
		8103	**32**
		8105	30
		8089	46
		8089	46
		8106	29
JAJ9	0		
KF86	10	**7121**	**379**
		7121	379
		7294	206

		7288	**212**
		7288	**212**
		7294	**206**
		7288	**212**
		7344	**156**
		8009	126
		8033	**102**
		8042	93
		8033	**102**
		8058	77
		8058	**77**
		8034	**101**
		8048	87
		8048	87
		8099	36
		8099	36
MHBA	4	**7189**	**311**
		7294	206
		7329	171
		7335	165
P1Y0	11	7233	267
		7148	**352**
		7154	346
		7239	261
		8049	86
		8092	43
		8092	43
		8092	43
		8092	43
		8092	43
		8092	43
PK86	13	**6320**	**546**
		6320	546
		6320	546
		6320	546
		6320	546
		6320	546
		7083	**417**
		7085	415
		7104	396

		7100	400
		7160	340
		7290	**210**
		7290	210
		7290	**210**
		7324	**176**
		7211	**289**
		6320	546
PWC4	54	**8016**	**119**
		8033	102
		8033	102
		8016	119
		8035	100
		8036	99
		8036	99
		8037	98
		8015	120
		8033	102
		8013	122
		8034	101
		7296	**204**
		7357	143
		8051	84
		8054	81
		8015	120
		8051	84
		7357	143
		8054	81
		8054	81
		8068	67
		8068	67
		8049	86
		8049	86
		8049	86
		8036	99
		8049	86
		8054	81
		8015	120
		8044	91
		8069	66

		8069	66
		8061	**74**
		8061	74
		8061	74
		8063	72
		8063	72
		8063	72
		8073	62
		8069	66
		8069	66
		8069	66
		8070	65
		8070	65
		8070	65
		8073	**62**
		8073	62
		8073	62
		8073	62
		8073	62
		8073	62
		8073	62
		8073	62
		8073	62
		8073	62
		8069	66
		8069	66
		8071	64
		8071	64
		8071	64
		8090	45
		8090	45
		8070	65
		8070	65
		8071	64
		8071	64
		8071	64
		8071	64
		8070	65
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PXBA	0		
Q2H4	4	**6296**	**570**
		7198	302
		7197	**303**
		7308	**192**
Q4V7	5	**7282**	**218**
		8119	16
		7295	205
		7295	205
		7295	205
		7295	205
		8119	16
		7281	**219**
		7281	**219**
		7281	219
		7281	219
		6352	**514**
		7044	**456**
		7268	232
		7268	**232**
		7268	232

		8119	16
		7280	**220**
		7253	247

REFERENCES

BOOKS

Blanchard, B.S., *Logistics Engineering and Management*, Prentice Hall, Fourth Edition, 1992

Heizer, J.H. and Render, B., *Production and Operations Management; Strategic and Tactical Decisions*, Prentice Hall, Fourth Edition, 1995

Levine, D.M., Berenson, M.L., and Stephan, D., *Statistics For Managers*, Prentice Hall, 1997

Wallace, T.F., *MRP II: Making It Happen*, Oliver Wight Limited Publications, Inc., Second Edition, 1990

Wight, O.W., *MRP II: Unlocking America's Productivity*, CBI Publishing, 1982

THESES

Cruz, D.F., *Repair Cycle Time Reduction at Naval Aviation Depots Via Reduced Logistics Delay Time,* Master's Thesis, Naval Postgraduate School, 1997

Mooney, K.F.and Sanchez, G.R, *Improved Aviation Readiness and Inventory Reductions Through Repair Cycle Time Reductions Using Modeling and Simulation*, Master's Thesis, Naval Postgraduate School, 1997

NAVY INSTRUCTIONS

Aviation Supply Office, ASO Instruction 4710.15A; "Level Schedule Item Repair Requirements Determination", 28 April 1988

Naval Air Systems Command, NAVAIR Instruction 4440.6D; "Management of Condition Code G Repairable Components", 15 November 1988

Naval Supply Systems Command, NAVSUP Publication 485; "Afloat Supply Procedures", 1 March 1997

Ships Parts Control Center, SPCC Instruction 4440.46; "COSAL Use and Maintenance Manual", 13 November 1987

INTERVIEWS

Jaramillo, FISC SD Site NADEP 100D, Personal interview on 22 April 1998

Giacalone, FISC SD Site NADEP 100, Personal interview on 23 April 1998

Deguzman, FISC SD Site NADEP 100, Personal interview on 24 April 1998

Fancy, NADEP NI 93001D, Personal interview on 23 April 1998

Fancy, NADEP NI 93001D, Personal interview on 29 May 1998

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